BULLETIN

OF THE

TORREY BOTANICAL CLUB

VOL. 31

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CONTENTS

ARTHUR, J. C. New species of Uredineae, III - - - - - - 1
HARPER, R. M. Explorations in the coastal plain of Georgia during the season of 1902 (with four figures) - - - - - - - - 9
MURRILL, W. A. The Polyporaceae of North America, VI. The genus Polyporus - - - - - - - - - - - - 29
ROBINSON, W. J. The spines of Fouquieria (with thirteen figures) - 45
RICHARDS, H. M. and MACDOUGAL, D. T. The influence of carbon monoxide and other gases upon plants - - - - - - - 57
BERRY, E. W. Additions to the flora of the Matawan formation (with plates 1–5) - - - - - - - - - - - - - 67
GRIFFITHS, D. Concerning some West American smuts (with seventeen figures) - - - - - - - - - - - - - 83
DANDENO, J. B. The mechanics of seed-dispersion in Ricinus communis - - - - - - - - - - - - - - - 89
HOWE, M. A. Notes on Bahaman algae (with plate 6) - - - - 93
ARTHUR, J. C. Taxonomic importance of the spermogonium (with two figures) - - - - - - - - - - - - - - 113
HARSHBERGER, J. W. A phyto-geographic sketch of extreme southeastern Pennsylvania (with four figures) - - - - - - - 125
CUSHMAN, J. A. Desmids from southwestern Colorado (with plate 7) - 161
BRITTON, N. L. Four new North American birches - - - - - 165
RICHARDS, H. M. and MACDOUGAL, D. T. The influence of carbon monoxide and other gases upon plants: a correction - - - - 167
PECK, C. H. New species of fungi - - - - - - - - - 177
EVANS, A. W. Hepaticae of Puerto Rico, IV. Odontolejeunea, Cyclolejeunea and Prionolejeunea (with plates 8–12) - - - - - 183
MORGAN, T. H. Polarity and regeneration in plants (with a figure) - 227
NELSON, A. New plants from Wyoming, II - - - - - - - 239
WATTERSON, A. The effect of chemical irritation on the respiration of fungi - - - - - - - - - - - - - - - 291
SALMON, E. S. A revision of some species of Ectropothecium (with plates 13 and 14) - - - - - - - - - - - - - 309
MURRILL, W. A. The Polyporaceae of North America, VII. The genera Hexagona, Grifola, Romellia, Coltricia and Coltriciella - 325
COOK, O. F. The nomenclature of the royal palms - - - - - 349
OSTERHOUT, G. E. Notes on Colorado plants (with a figure) - - 357
GRUENBERG, B. C. and GIES, W. J. Chemical notes on "bastard" logwood (with two figures) - - - - - - - - - - - 367

134387

BICKNELL, E. P. Studies in Sisyrinchium, X. The species of California - - - - - - - - - - - - - - 379
CUSHMAN, J. A. Notes on Micrasterias from southeastern Massachusetts (with three figures) - - - - - - - - - 393
RYDBERG, P. A. Studies on the Rocky Mountain flora, XI - - 399
MURRILL, W. A. The Polyporaceae of North America, VIII. Hapalopilus, Pycnoporus and new monotypic genera - - - - - 415
SHAW, C. H. Note on the sexual generation and the development of the seed-coats in certain of the Papaveraceae (with plate 15) - 429
CANNON, W. A. Observations on the germination of Phoradendron villosum and P. californicum (with six figures) - - - - - 435
GRIGGS, R. F. Two new species of American wild bananas with a revision of the generic name - - - - - - - - - - - 445
VAIL, A. M. Studies in the Asclepiadaceae, VIII. A new species of Asclepias from Kansas and two possible hybrids from New York (with plates 16–19) - - - - - - - - - - - - 457
COCKERELL, T. D. A. The North American species of Hymenoxys (with plates 20–23) - - - - - - - - - - - - - 461
BESSEY, C. E. The chimney-shaped stomata of Holacantha Emoryi (with plate 24) - - - - - - - - - - - - - - 523
KELLICOTT, W. E. The daily periodicity of cell-division and of elongation in the root of Allium (with eight figures) - - - - - 529
EMERSON, J. T. Relationship of Macrophoma and Diplodia (with plate 25) - - - - - - - - - - - - - - - 551
RYDBERG, P. A. Studies on the Rocky Mountain flora, XII - - 555
CUSHMAN, J. A. Desmids from Newfoundland (with plate 26) - - 581
HORNE, W. T. An anomalous structure on the leaf of a bean seedling (with five figures) - - - - - - - - - - - - 585
HOUSE, H. D. The nomenclature of Calonyction bona-nox - - 589
MURRILL, W. A. The Polyporaceae of North America, IX. Inonotus, Sesia and monotypic genera - - - - - - - - - - 593
BRITTON, N. L. On Pisonia obtusata and its allies - - - - 611
EMERSON, J. T. Notes on the blackening of Baptisia tinctoria - - 621
RYDBERG, P. A. Studies on the Rocky Mountain flora, XIII - - 631
MAXON, W. R. A new Asplenium from Mexico (with a figure) - - 657

CODE OF BOTANICAL NOMENCLATURE - - - - - - - - 249
CODE DE LA NOMENCLATURE BOTANIQUE - - - - - - - 263
KODEX DER BOTANISCHEN NOMENKLATUR - - - - - - - 277

INDEX TO AMERICAN BOTANICAL LITERATURE (1901–1903)
51, 101, 169, 449
INDEX TO AMERICAN BOTANICAL LITERATURE (1904)
231, 305, 359, 411, 511, 577, 617, 659

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Errata

Page 18, the comma at the end of line 7 belongs at the end of line 6, and the period at the end of line 8 belongs at the end of line 7.

Page 87, line 32, for *Harvardii* read *Havardi*.

Page 88, line 36, for *Clathorix* read *Cladothrix*.

Page 215, line 10, for **innovota** read **innovata**.

Page 288, line 15, for "urspünglich." read "ursprünglich."

Page 347, line 18, for "Blowing Rock" read "Flat Rock."

Page 569, lines 33 and 37, for *E.* read *G.*

The most important errors in the *Index to American botanical literature* which have been noted are the following:

Abrams, L. R. Flora of Los Angeles, etc. In the note, for "following" read "flowering" (page 231).

Barrett, O. W. Correction and comment. The date should be 1904 instead of 1902 (page 232).

Eaton, A. A. A preliminary list of *Pteridophyta*, etc. For "Dead County" read "Dade County" (page 362).

Emerson, J. T. Initials incorrectly given as **J. E.** (page 618).

Parlin, J. C. Some causal elements, etc. For "causal" read "casual" (page 519).

Pierre, L. Incorrectly spelled **Peirre** (page 413).

Sheldon, E. P. The forest wealth of Oregon. For "1–52" read "1–32" (page 580).

VOL. 31 No 1.

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JANUARY, 1904

New species of Uredineae — III.

J. C. ARTHUR

The following sixteen species of rusts have been detected among material sent for identification, in large part submitted by Professor F. S. Earle, curator of fungi of the New York Botanical Garden. I am also directly indebted for material to E. W. D. Holway, C. V. Piper, J. M. Bates and E. Bartholomew and indirectly to Messrs. Heller, Baker, Tracy, Goodding, Craig, Underwood and Griggs. Two thirds of the species are trans-Mississippian, and the remainder from Porto Rico. It is worthy of special note that, with the exception possibly of four species at the most, the descriptions here given are incomplete, as they include but one or two out of the possible three, four, or even more spore-forms. It should be the endeavor of those botanists, who are privileged to collect in the regions where these species abound, to secure the remaining spore-forms in order that the descriptions may be completed.

Uromyces Pavoniae sp. nov.

III. Teleutosori hypophyllous, round, crowded in circinating groups, 1–3 mm. across, compact, early naked, pulvinate, chestnut-brown; teleutospores obovate-globose, 18–20 by 23–28 μ, rounded at both ends; wall medium thick, 2–3 μ, thicker above, 4–7 μ, smooth, chestnut-brown; pedicel slender, colorless, once to twice length of spore.

On *Pavonia racemosa* L., between Mayaguez and Joyua, Porto Rico, June 14 to July 22, 1901, *L. M. Underwood, no. 193*. The species belongs to the section *Lepto-Uromyces*, as the spores germinate in the sorus.

[The preceding number of the BULLETIN, Vol. 30, No. 12, for December, 1903 (30: i-vi, 641–709, *pl. 29, 30*), was issued 5 D 1903.]

Uromyces Hellerianus sp. nov.

O, I. Spermogonia and aecidia unknown.

II. Uredosori hypophyllous, round, early naked, pulverulent, light chestnut-brown, encircling epidermis inconspicuous; uredospores globose, sometimes triangular-globose, 20–26 μ in diameter; wall thin, 1.5–2 μ, cinnamon-brown, pores 2 or 3, scattered.

III. Teleutosori hypophyllous, round, early naked, pulverulent, dark chestnut-brown, encircling epidermis inconspicuous; teleutospores globoid to ovoid, 21–24 by 27–36 μ, rounded at both ends; wall smooth, chestnut-brown, thick, 3 μ, apex with a prominent, hyaline umbo, 7–11 μ; pedicel less than half length of spore, delicate, colorless.

On *Cayaponia racemosa* (Sw.) Cogn., Adjuntas road five miles from Ponce, Porto Rico, December 4, 1902, *A. A. Heller, no. 6206*. Differs from *Uromyces Cayaponiae* P. Henn. especially in having smooth teleutospores with a large umbo.

Puccinia Canadensis sp. nov.

III. Teleutosori amphigenous, somewhat gregarious, pustular, coalescing, soon naked, pulverulent, chestnut-brown, remains of the membranous epidermis conspicuous; teleutospores narrowly elliptical or linear-oblong, 10–15 by 37–58 μ, obtuse at both ends; wall thin, 1–2 μ, cinnamon-brown, minutely rugose, hyaline and thicker at apex, 3–5 μ; pedicel delicate, very short, colorless, partially deciduous.

On *Viola orbiculata* Geyer (type), Laggan, Alberta, August 23, 1902, and Glacier, British Columbia, September 3, 1902; both collections by *E. W. D. Holway*. Hosts determined by Edward L. Greene. This species is the American representative of the European *P. alpina*, and like it belongs to the section *Micropuccinia*. It differs in having paler and more slender spores, with more irregular sculpturing, which is so minute that it can scarcely be detected except when dry.

In July, 1901, the writer with Mr. Holway published a paper in the *Minnesota Botanical Studies* on the violet rusts of North America, in which *Aecidium pedatum* (Schw.) Arth., *Puccinia Violae* (Schum.) DC. and *P. effusa* D. & H., the then known species, were fully described. Since that time Mr. Holway has not only collected the above additional species, but has also found *P. Fergussoni* B. & Br. on *Viola Langsdorfii* Fisch., at Glacier, B. C., August 10, 1901.

Puccinia Parnassiae sp. nov.

III. Teleutosori amphigenous, somewhat gregarious, pustular, coalescing, soon naked, pulverulent, chocolate-brown, membranous epidermis conspicuous; teleutospores elliptical, 16–20 by 30–37 μ, rounded or obtuse at both ends; wall uniformly thin, 1–2 μ, chestnut-brown, smooth or obscurely punctate above, sometimes with slight hyaline umbo at apex; pedicel colorless, half the length of spore or less, appearing shorter by being partially deciduous.

On *Parnassia fimbriata* Banks, Banff, Alberta, August 16, 1902 (type), *E. W. D. Holway*. Also on same host at Silver Lake, Utah, 9,000 ft. alt., August 15, 1903, *A. O. Garrett, no. 288*. The species apparently possesses no uredo, as no trace of uredospores could be found even in the teleutosori. It may belong to the section *Micropuccinia*. A species of *Uromyces* occurs on *Parnassia* in Europe and a heteroecismal *Aecidium*, but no *Puccinia*. The *Uredo Parnassiae* West. of Belgium, said to be on *Parnassia palustris*, is shown by Lagerheim to be an error for *Uromyces Valerianae*.

Puccinia Sieversiae sp. nov.

III. Teleutosori amphigenous, but more beneath, scattered, round or oval, at first bullate and covered by the thin epidermis, soon naked, pulverulent, chestnut-brown; teleutospores elliptical or obovate-oblong, 20–26 by 32–40 μ, rounded at both ends or somewhat narrowed below, slightly or not constricted at the septum; wall obscurely rugose, appearing smooth, cinnamon-brown, medium thick, 1.5–2.5 μ, thicker above, 4–6 μ, sometimes with semi-hyaline umbo; pedicel short, half length of spore or less, delicate, nearly colorless.

On *Sieversia turbinata* (Rydb.) Greene, Fish Lake, Uintah Mts., Utah, July 17, 1902, *Leslie N. Goodding, no. 1377*. The species is one of the very few belonging to this genus occurring upon the *Rosaceae*.

Puccinia Bakeriana sp. nov.

II. Uredosori hypophyllous, round, early naked, pulverulent, cinnamon-brown; uredospores large, globose, or obovoid, 34–42 by 39–45 μ; wall light honey-yellow, thick, 4–6 μ at sides, 12 μ at apex, closely and coarsely tuberculate, pores large, three, approximately equatorial; contents orange when fresh, segregated.

III. Teleutosori hypophyllous, scattered, round, early naked, pulverulent, chocolate-brown; teleutospores ellipsoid, sometimes

obovate-oblong, irregular, 24–32 by 40–55 μ, rounded at both ends, slightly or not constricted at the septum; wall uniformly medium thick, 2.5–3 μ, noticeably and closely tuberculate, chocolate-brown; pedicel short, colorless, incompletely deciduous.

On *Heracleum lanatum* Michx., Pillar Point, San Mateo County, California, October 1, 1902, *C. F. Baker, no. 1735.*

Puccinia Diplachnis sp. nov.

II. Uredospores in the teleutosori broadly ellipsoid or nearly globose, 19–21 by 24–26 μ; wall colorless, thick, 3 μ, closely and finely verrucose, pores apparently 4, equatorial.

III. Teleutosori chiefly hypophyllous, oblong or linear, soon naked, pulvinate, prominent, compact, blackish-brown; teleutospores ellipsoid, 20–24 by 32–39 μ, slightly or not contracted at the septum, rounded or obtuse at both ends; wall smooth, medium thick, 1.5–2.5 μ, thicker at the apex, 3–7 μ, chestnut-brown; pedicel tinted next the spore, one to two and a half times length of the spore.

On *Diplachne dubia* Benth., Big Springs, Texas, October 13, 1902, *S. M. Tracy, no. 8270.* The description of the uredo stage is incomplete, as no separate sori were seen. It is probable that the rust on *Diplachne serotina* of Germany is the same species, judging from Sydow, *Uredineen, no. 414*, although both the uredo and teleutospores are a little larger than in the American specimen. The species differs materially from *Puccinia australis* Körn. on *Molinia*, which has its aecidum on *Sedum.* In *P. australis* the teleutosori and spores are lighter colored, and the uredospores have thicker, deep golden yellow walls, with coarser sculpturing.

Puccinia Helianthellae sp. nov.

II. Uredosori amphigenous, scattered, round, soon naked, pulverulent, chestnut-brown; uredospores globose, large, 25–32 μ in diameter; wall chestnut-brown, thick, 3 μ, finely and sparingly echinulate with blunt points, pores 2, equatorial and opposite.

III. Teleutosori amphigenous, scattered, round, soon naked, pulverulent, chestnut-brown; teleutospores ellipsoid, or obovate-oblong, 20–26 by 30–40 μ, rounded or obtuse at both ends, slightly or not constricted at the septum; wall smooth, chestnut-brown, medium thick, 2–2.5 μ, sometimes slightly thicker at apex, 2.5–4 μ; pedicel colorless, delicate, often as long as the spore, imperfectly fugacious.

On *Helianthella Nevadensis* Greene, Nevada County, California, July 31, 1903, *A. A. Heller, no. 7072.* An easily recognizable species on account of its large, thick-walled uredospores, which are of the same shade of brown as the teleutospores. It is probable that *Aecidium Helianthellae* Arth. (Bull. N. Y. Bot. Gard. **2**: 348), found in Wyoming, is an early stage of this species, but no direct proof is at hand.

Ravenelia Caesalpiniae sp. nov.

O. Spermogonia chiefly epiphyllous, arising beneath the cuticle, crowded in small groups, depressed, 15–18 μ high by 60–100 μ broad, golden yellow, becoming brownish.

II. Uredosori chiefly hypophyllous, arising beneath the cuticle, at first in small groups circinating about the spermogonia, finally irregularly scattered, roundish or oblong, at first yellowish, afterward ochraceous, ruptured cuticle noticeable; uredospores obovate-cuneate, 16–23 by 28–35 μ; wall thin, 1.5–2 μ, sometimes slightly thicker above, 1.5–3 μ, chestnut-brown, often paler and almost hyaline below, nearly or entirely smooth above, prominently and evenly echinulate below, pores 4, a little above the middle; paraphyses of the periphery clavate, nearly colorless, wall uniformly thin, 1–1.5 μ, paraphyses intermixed with the spores numerous, capitate, slightly tinted above, head globose with very thick wall, pedicel solid.

III. Teleutospores unknown.

On *Caesalpinia* sp., near Bayamon, Porto Rico, June 14–July 22, 1901, *L. M. Underwood* and *R. F. Griggs, no. 879.*

Ravenelia Portoricensis sp. nov.

II. Uredosori amphigenous, in circinating groups about 3 mm. across, subepidermal, soon naked, pulverulent, fulvous, encircling epidermis noticeable; uredospores elliptical, 16–18 by 24–29 μ; wall medium thick, 2.5 μ, golden yellow, thickly echinulate, pores 8, scattered; paraphyses none.

III. Teleutospores unknown.

On *Cassia emarginata* L., Ponce, Porto Rico, December 3, 1902, *A. A. Heller, no. 6193.*

Uredo superior sp. nov.

II. Uredosori amphigenous, elongated, tectate, spores escaping through slits in the epidermis; uredospores globoid, 28–34 by 32–34 μ; wall thick, 3–4 μ, light chestnut-brown, thickly echinulate, pores 2, in upper hemisphere.

On *Fimbristylis spadicea* Vahl, borders of low swampy ground along the coast eight miles west of Ponce, Porto Rico, December, 1902, *A. A. Heller, no. 6279*. The spores are very much larger and coarser than those of the *Puccinia* occurring on *Fimbristylis* in Mexico. No teleutospores were found.

Aecidium Onosmodii sp. nov.

O. Spermogonia amphigenous, in very small circular groups, inconspicuous, punctiform, honey-yellow, entirely immersed, subepidermal, seen in vertical section globose, 90–120 μ in diameter; ostiolar filaments 60–80 μ long.

I. Aecidia hypophyllous, is small circular groups, or solitary, small, pustular; peridia delicate, erect or somewhat recurved, margin coarsely lacerate, peridial cells much thicker on outer than on inner side; aecidiospores globoid, 19–23 by 20–29 μ; wall colorless, medium thick, 2–2.5 μ, closely and finely verrucose.

On *Onosmodium molle* Michx. Type collection from Callaway, Nebraska, May 25, 1902, *J. M. Bates*. It has also been reported from Kansas (Bartholomew, Kans. Ured. 180) and North Dakota (Bolley, Agric. Sci. **5**: 263), both on *O. Carolinianum* DC.

Aecidium Mertensiae sp. nov.

O. Spermogonia epiphyllous, in small circular groups, crowded, punctiform, wholly immersed, subepidermal, seen in vertical section, globose, 65–120 μ in diameter; ostiolar filaments 60–90 μ long.

I. Aecidia hypophyllous, in circular groups, crowded, broad and low; peridia spreading, recurved, coarsely lacerate; aecidiospores globoid, 19–26 by 22–28 μ; wall colorless, very thin, 1–2 μ, minutely and closely verrucose, appearing smooth; contents deep orange-yellow.

On *Mertensia paniculata* (Ait.) Don, near Lolo Creek, in the Bitter Root Mountains, Idaho, August 10, 1902, *C. V. Piper*. On *M. Sibirica* (L.) Don, Jefferson Lake, Marion County, Oregon, August, 1892, *Moses Craig*. The former to be taken as the type.

Aecidium malvicola sp. nov.

O. Spermogonia epiphyllous, in groups, punctiform, honey-yellow, immersed, subepidermal, in vertical section globose, 100–125 μ in diameter; ostiolar filaments very numerous, 35–80 μ long.

I. Aecidia hypophyllous, in diffuse circular groups often 10 mm. in diameter; peridia short, cylindrical, margin erect or somewhat revolute, erose; aecidiospores globoid, 14–22 by 16–24 μ; wall colorless, thin, 1.5 μ, minutely and evenly verrucose.

On *Althaea rosea* L. (type), Callaway, Nebraska, July 1, 1902, *J. M. Bates.* On *Malvastrum coccineum* (Pursh) Gray, Wakeeney, Kansas, June 15, 1903, and *Callirrhoe involucrata* (Nutt.) Gray, Rooks County, Kansas, May 31, 1902, *E. Bartholomew.* There are three species of *Aecidium* occurring upon various malvaceous hosts found on the western plains. It is not difficult to distinguish them. *Aecidium tuberculatum* E. & K. has very large aecidial cups of a bright orange color when fresh, *Ae. malvicola* Arth. has average-sized aecidial cups also orange-colored when fresh, and *Ae. Napaeae* A. & H. (of which *Ae. Callirrhoes* E. & K. is a synonym) has slightly smaller aecidial cups which are nearly or quite colorless even when fresh. Beside these, *Ae. roestelioides* E. & E. of Texas has orange-red aecidial cups, the margins of which are slit into long spreading filaments that appear yellow.

Aecidium occidentale sp. nov.

O. Spermogonia amphigenous, in small groups, crowded, rather prominent, honey-yellow, punctiform, wholly immersed, subepidermal, in vertical section globose or somewhat depressed, 110–150 μ in diameter; ostiolar filaments free or somewhat agglutinate, 30–75 μ long.

I. Aecidia hypophyllous, in circular or sometimes elongated groups, rather crowded, broad and low; peridia pale, margin erect, erose; aecidiospores globoid, 18–24 by 23–29 μ; wall medium thick, 2.5–3 μ, colorless, closely and finely verrucose.

On *Clematis Douglasii* Hook., Pullman, Washington, June 2, 1894, *no. 499* (type), and June, 1893, *no. 132, C. V. Piper;* Pullman, Washington, June, 1892, *N. R. Hull;* Moscow, Idaho, May 30, 1897, *L. F. Henderson, no. 4326;* Helena, Montana, June 5, 1889, *F. D. Kelsey.* This species is distinguished from *Ae. Clematidis* DC., which occurs in the same region, by its somewhat smaller and more delicate aecidial cups and spores. The aecidia are also more diffusely grouped, and the spermogonia more prominent. The fungus does not appear to thicken the leaf materially, or produce distortions.

Aecidium recedens sp. nov.

O. Spermogonia amphigenous, few, in small circular groups, punctiform, honey-yellow, wholly immersed, subepidermal, in vertical section globose, 90–110 μ in diameter; ostiolar filaments 45 μ long.

I. Aecidia amphigenous, in restricted circular groups, pustular, constricted by the tissues of the substratum; peridia delicate, evanescent; aecidiospores globoid, 16–23 by 22–29 μ; wall thick, 3 μ, golden-yellow, closely and finely verrucose.

On *Solidago mollis* Bartl., Callaway, Nebraska, June 7, 1902 (type), *J. M. Bates;* Cypress Hills, Assiniboia, *J. Macoun.* The second collection is in the Ellis Herbarium at the New York Botanical Garden, and is erroneously labeled "Aecidium of *Puccinia Columbiensis* E. & E. on *Oenothera biennis.*" It is referred to by Mr. Holway in Jour. Myc. **8**: 171, December, 1902. A part of the same collection is in the National Herbarium at Washington. The species is readily told from the common *Aecidium* on *Solidago* by the evanescent peridium, and by the larger spores, having thick, golden-yellow walls.

PURDUE UNIVERSITY.

Explorations in the coastal plain of Georgia during the season of 1902

ROLAND M. HARPER

My explorations in Georgia in 1902, beginning at Augusta on June 5 and ending near the same place on November 16, were confined to those counties lying wholly or partly in the coastal plain. Notes and collections were made in the counties of Columbia (nos. *1294–1302, 1310–1314* *), Richmond (*1303–1309, 1315–1321*), Burke, Jefferson, Glascock (*1322–1326*), Washington (*1327–1331*), Johnson (*1332–1347*), Laurens (*1348–1373*), Dodge, Pulaski (*1374–1387*), Wilcox, Dooly (*1712*), Sumter (*1388–1406, 1713–1731*), Marion (*1407–1410*), Schley (*1411–1413*), Irwin (*1414–1422, 1702–1704, 1708–1711*), Coffee (*1423–1463*), Appling, Pierce (*1464–1467*), Ware (*1468–1470*), Charlton (*1471–1516, 1573–1577*), Wayne, Glynn (*1518–1537*), Camden (*1517, 1538–1572*), Clinch (*1578–1580, 1583–1585*), Echols (*1581–1582*), Lowndes (*1586–1615*), Brooks (*1616–1633*), Thomas (*1634–1639*), Colquitt (*1640–1676*), Berrien (*1677–1696, 1699–1701, 1705–1707*), Worth (*1697, 1698*), Lee, Terrell, Randolph (*1732–1745, 1758–1784*), Quitman (*1746–1757*), Clay (*1786–1793*), Webster, Stewart, Chattahoochee (*1794, 1795*), Muscogee (*1796–1800*), Talbot, Taylor (*1801–1803*), Crawford (*1804*), Houston, Bibb (*1805–1808*), Jones, Wilkinson and Screven, approximately in the order named. Numbers *1294–1387* were collected in June, *1388–1463* in July, *1464–1585* in August, *1586–1701* in September, *1702–1793* in October, and *1794–1808* in November. One hundred and fifty-two numbers of bryophytes and thallophytes, which do not appear in the foregoing enumeration, were also collected.

My travels by rail within the state covered more than 1500 miles, less than 200 of which were the same as had been traversed the previous season. About 400 photographs of the vegetation and scenery were taken.

Whenever opportunity offered special attention was paid to the

* Numbers of the plants collected.

problem of determining the exact location of the fall-line, or inland boundary of the coastal plain. I ascended the Savannah, Ocmulgee, Flint and Chattahoochee Rivers and Rocky Comfort Creek (the latter in Glascock County) to beyond their intersections with this line, and also followed it pretty closely by rail through the counties of Muscogee and Talbot.

Many of the oldest and largest cities of the Middle and South Atlantic States are situated on this fall-line, which usually marks the head of navigation, and in many cases the greatest water-power, on the rivers which cross it. But botanists who have collected around these cities have almost invariably failed to indicate whether their plants came from the hill country above or the coastal plain below. From a phytogeographical standpoint this is a most serious omission, for the fall-line, throughout its length of hundreds of miles, is (in the words of Dr. McGee *) "one of the most strongly marked physiographic and cultural lines on the surface of the globe," and "the most important structural line of eastern United States." The rather vaguely defined "Austroriparian area" of some botanists — or rather biologists — is practically the coastal plain, and the boundary between that and the "Carolinian area" is simply the fall-line, the cause of which is purely geological, and not climatic.

It should not be inferred, however, that the fall-line is always so sharply defined as to be visible in the field at a single glance. On the contrary it cannot usually be definitely located within a mile or two, except along the larger streams. Nevertheless, it seems to be an impassable barrier for many species of plants; and the great difference in aspect of the topography and flora on opposite sides of this line is apparent to the most indifferent observer.

A few places of historical or geographical interest visited on this trip will now be mentioned.

In June I spent a week in the vicinity of Augusta, where the most interesting natural feature, to a botanist at least, is the sand-hills, so well known to winter visitors. These are part of a line of sandy elevations which extend along or near the fall-line from

* Ann. Rep. U. S. Geol. Surv. 12[1]: 356, 357. 1891. The introductory portion of this paper is recommended to the careful consideration of the reader.

central North Carolina to western Georgia, with some interruptions. Little is known of the origin and geological history of these fall-line sand-hills, and they deserve further study. Their flora is of course eminently xerophytic, but need not be discussed here.

Augusta was visited in the eighteenth century by Bartram and Michaux, and in the nineteenth by Baldwin, Croom, Leavenworth, Olney, Ravenel, McCarthy, Sargent, Small and other botanists. It is now the home of Mr. A. Cuthbert, the discoverer of several species new to science, with whom I had the pleasure of compar-

FIG. 1. General view of fall-line sand-hills near Augusta. June 8.

ing notes. The influence of Michaux's work in this vicinity is strikingly shown by the fact that of the flora of these particular sand-hills most of the characteristic species and several of the genera were discovered and described by him.

In November I examined other portions of the fall-line sand-hills, in the counties of Talbot, Taylor and Jones. The area in Talbot and Taylor Counties extends about twenty miles east and west and perhaps nearly as far north and south, but is little known.

Here the sand-hills rise to six or seven hundred feet above sea-level and considerably above the adjacent metamorphic hills. They are comparatively level, however, as is well illustrated at Tangent in Taylor County, where the railroad track is straight beyond the horizon in both directions. This region is sparsely settled, and its pine forests still furnish lumber and turpentine in merchantable quantities. The manufacture of turpentine here is of interest because a distance of at least fifty miles, including the whole width of the outcrop of the Eocene formations, intervenes between this and the pine-barren region where the rest of the turpentine of Georgia is now produced.

This western sand-hill area seems to have been first made known to science by Elliott. Bartram, who traversed these counties (or rather the area now included in them) in the summer of

FIG. 2. Open portion of Okefinokee Swamp. August 7.

1776, and again the following winter, must have passed just to the north of the sand-hills, for he does not mention them in his *Travels*. Elliott visited them early in the nineteenth century, and discovered there several new species, among them *Chrysopogon secundus*, *Thysanella fimbriata*, *Dicerandra linearifolia* and *Chrysopsis pinifolia*, * all of which I also saw in the same region. Elliott's route was along the "Federal Road," which runs along or near the fall-line and connects the present cities of Macon and Columbus (neither of which existed in Elliott's time).

Since Elliott no botanist seems to have explored these western

* See Bot. S. C. & Ga. 1: 580, 583; 2: 94, 335.

sand hills except the late Dr. Hugh M. Neisler, who lived for many years in Butler, the county-seat of Taylor County, and sent specimens from there (many of which are now preserved in the Torrey Herbarium) to Dr. Torrey. At Reynolds, in the same county, I met a grandson of Dr. Neisler, who took me to another historic spot, the site of the Indian Agency at the crossing of the Federal Road and Flint River, where Dr. Baldwin spent several weeks in the spring of 1812.* The two species which Dr. Baldwin discovered here I was unable to find. But on the river bank just above the Agency (and at or near the fall-line) I saw growing in intimate association *Hydrangea quercifolia* and *Hypericum aureum*, both of which were discovered within a few miles of this place by Bartram in July, 1776, the former east of the river and the latter west. Both were also noted near the Agency by Dr. Baldwin.

In June I explored portions of the sand-hills of the Oconee and Ocmulgee Rivers, opposite Dublin and Hawkinsville respectively. These river sand-hills are probably of a different origin from the fall-line sand-hills, but their flora is similar in composition and almost identical in aspect. Analogous sand-hills occur along the left sides of many other streams in Southeast Georgia, but are rare in Southwest Georgia and seem to be unknown in Alabama.

In August I spent two days (6th to 8th) in Okefinokee Swamp (which is mostly in Charlton County), in company with Mr. P. L. Ricker, of the U. S. Department of Agriculture. Okefinokee Swamp differs materially from the two other great swamps of the eastern United States (Dismal Swamp and the Everglades) in being about 50 miles inland and over 100 feet above sea-level, but it has several features in common with each. No account of the flora of Okefinokee has ever been published, but space will not permit a detailed description here. The swamp, although exceedingly interesting phytogeographically, seemed to contain no endemic species of flowering plants. About 75 species were observed, but this may not be over half the total number in the swamp.

Later in the same month we visited two islands on the neighboring coast, both now favorite summer resorts: St. Simon's, in Glynn County, and Cumberland, in Camden. These islands were

* See Reliq. Baldw. 58–62 *et seq.*

visited in the eighteenth century by Bartram and Michaux, but seem to have been untouched in the nineteenth by all botanists except Dr. Baldwin, who visited Cumberland occasionally during the few years of his residence at St. Mary's, on the adjacent mainland. Some portions of Cumberland island rise about 50 feet above sea-level, which is higher than most, if not all, of the other islands along the Georgia coast, and probably as high as any part of the mainland of Camden County. The floras of the two islands are remarkably different, considering their proximity to each other and to the mainland.

On September 4 I visited two interesting bodies of water in the southern part of Lowndes County, near Lake Park. Ocean

FIG. 3. Ocean Pond, Lowndes County. September 4.

Pond, the larger of the two, is said to be about two miles in diameter, and is probably the largest pond in the state. But, strange to say, for over fifty years it has been represented seven or eight miles from its true position on all maps of the state which show it at all. Its water is quite clear and the shore mostly sandy, like that of Open Pond in Decatur County, * which I visited the summer before. Among other interesting plants seen in Ocean Pond and along its shores were *Sagittaria isoetiformis*, *Hydrochloa fluitans*, *Eriocaulon septangulare* (*no. 1608*), *Lachnocaulon Beyrichianum* (*no. 1607*), *Polygonum hirsutum* (*no. 1609*), and *Nymphaea orbiculata* (*no. 1610*).

* See Bull. Torrey Club, **30**: 290. My 1903.

Long Pond, about a mile away, is about half as large as Ocean Pond. Its water is also clear, but it has no shore (at least on the side examined), being bordered by a fringe of cypress swamp. It is analogous in many ways to Cane Water Pond in Decatur County.* In Long Pond I collected an apparently undescribed species of *Nymphaea* (*no. 1611*). These two ponds, like the two similar ones in Decatur County, are partly surrounded by dry sandy areas characterized by *Eriogonum tomentosum* and other xerophytes.

Toward the end of the same month I revisited the type locality of *Rhynchospora solitaria* and *Baldwinia atropurpurea*, the two species which I discovered in Tifton two years before. The locality (a characteristic area of primeval moist pine barrens) is so near the center of the city that it is in imminent danger of destruction by the encroachments of civilization, but fortunately both species are common enough elsewhere in the same and adjoining counties.

In October I studied portions of Randolph, Clay and Quitman Counties, in the Cretaceous and Eocene regions, making headquarters at Cuthbert for about three weeks. Cuthbert is one of the oldest cities in southwest Georgia, but seems never to have been visited by a traveling botanist before, though there was resident in the city at that time an enthusiastic amateur, Rev. C. H. Hyde, to whom I am indebted for his hospitality and for guiding me to many interesting places in the vicinity.

Cuthbert, though south of latitude 32°, has an elevation of nearly 500 feet and is several miles outside of the pine-barrens, in a region of red hills not unlike some of those in Middle Georgia. *Pinus palustris* seems to be entirely absent from a considerable area (whose limits have not yet been accurately determined) around Cuthbert and extending through several counties, where *P. echinata* takes its place.

On steep shaded hillsides and in rich ravines in this part of the state, where the original forest has not been destroyed, plants of more northern range abound, and I was continually surprised at finding such species as *Adiantum pedatum*, *Phegopteris hexagonoptera*, *Brachyelytrum erectum*, *Vagnera racemosa*, *Polygonatum biflorum*, *Uvularia perfoliata*, *Trillium erectum*, *Pogonia verticillata*

* See Bull. Torrey Club, 30: 290. My 1903.

(*no. 1762*), *Sanguinaria Canadensis*, *Actaea alba*, *Xanthorrhiza apiifolia*, *Hydrangea arborescens*, *Viola tripartita glaberrima*, *Dirca palustris* (*no. 1790*), *Panax quinquefolium*, *Kalmia latifolia* and *Phryma Leptostachya*, associated with coastal plain types like *Pinus glabra*, *Rhapidophyllum Hystrix* and *Magnolia grandiflora*. Other very interesting plants were found on the banks of the Chattahoochee River near Georgetown (in the Cretaceous region) and Fort Gaines (Eocene).

On October 23, in company with Mr. Hyde, I visited a cave (known as Grier's Cave), in Randolph County, about ten miles north of Cuthbert. Over several acres around this cave a compact limestone of the Midway or Clayton period (lowest Eocene) crops out in huge boulders and ledges, and supports a deciduous forest containing a great variety of herbs as well as trees. The aspect of the place is much like that of the Mountain Limestone area at the north end of Pigeon Mountain in Walker County,* and some species are common to the two places. An interesting feature of the flora of the rocky woods around Grier's Cave is the large number of plants with barbed fruits, adapted for dissemination by animals. Representatives of at least six families with this adaptation were observed.

The following species of more than ordinary interest were collected or observed in 1902:

ADIANTUM PEDATUM L.

Grows luxuriantly on the steep shady north side of a high bluff along Samochechobee Creek in Clay County, where I collected it on October 28 (*no. 1786*). This locality (in latitude 31° 38′) is, I believe, considerably farther south than any other known for this species, and is the only one known in the coastal plain in Georgia and adjacent states.

ADIANTUM CAPILLUS-VENERIS L.

Very abundant on the perpendicular rocky walls (Eocene) of the same creek near its confluence with the Chattahoochee River just above Fort Gaines. Seen also on the bluff of the river itself

* See Bull. Torrey Club, **28**: 456, 482. 1901.

at Fort Gaines, and just above Georgetown, where I collected it on overhanging Cretaceous rocks on October 16 (*no. 1756*).

ERAGROSTIS AMABILIS (L.) Wight & Arn.; Hook. & Arn. Bot. Beechey, 251. 1841

In the BULLETIN for July, 1902, Scribner and Merrill have reported the occurrence of this Asiatic ornamental grass in Middle Florida. In September I found it quite common as a weed along moist roadsides and railroad ditches in the vicinity of Quitman (*no. 1616*) and Moultrie. There is nothing in its mode of occurrence to suggest its having escaped from cultivation (if indeed it has ever been cultivated in that part of the country) and it seems to be thoroughly naturalized.

ERAGROSTIS SIMPLEX Scribn. Bull. Div. Agrost. U. S. Dept. Agric. No. 7, ed. 3, 250. 1900

"*E. Brownei* Nees" of Chapman and several other authors.

A weed of unknown origin which is common along most railroads in South Georgia, especially in the pine-barren region. Collected in Colquitt County, September 22 (*no. 1656*). Previously reported only from Florida.

FIMBRISTYLIS PERPUSILLA Harper; Small, Fl. S. E. States, 188. 1903

Although this species has already been described, it has several peculiarities which could not be mentioned in the limited space of the original description.

The plant was collected (in flower) on the muddy bottom of a dried-up pine-barren pond near Leslie, Sumter County, on the morning of October 9 (*no. 1729*). It was very abundant, but so small as to be scarcely visible to a person standing up. Its only associates visible to the naked eye were two bryophytes, *Riccia Sullivantii* and *Ephemerum tenerum*, the latter almost microscopic. The vegetative period of the *Fimbristylis* must be very brief and irregular, for the pond in which it grows cannot be expected to dry up at the same time every year, and there may be years in which it does not dry up at all.* In this respect our

*On July 13, 1903, I revisited the type-locality and found it covered by about three feet of water. No trace of the *Fimbristylis* could be found in several handfuls of mud taken from the bottom.

plant is inversely analogous to some species of *Isoetes* (*I. melanospora* and *I. Orcuttii*, for instance), which grow in shallow depressions on rocks and vegetate only in wet seasons.

Fimbristylis perpusilla is one of the smallest and simplest species of the genus, but it is too different from the other species occurring in the vicinity to be regarded as a depauperate form of any of them and besides the specimens were perfectly healthy and vigorous, *F. autumnalis* sometimes finds its way into pine-barren ponds as.

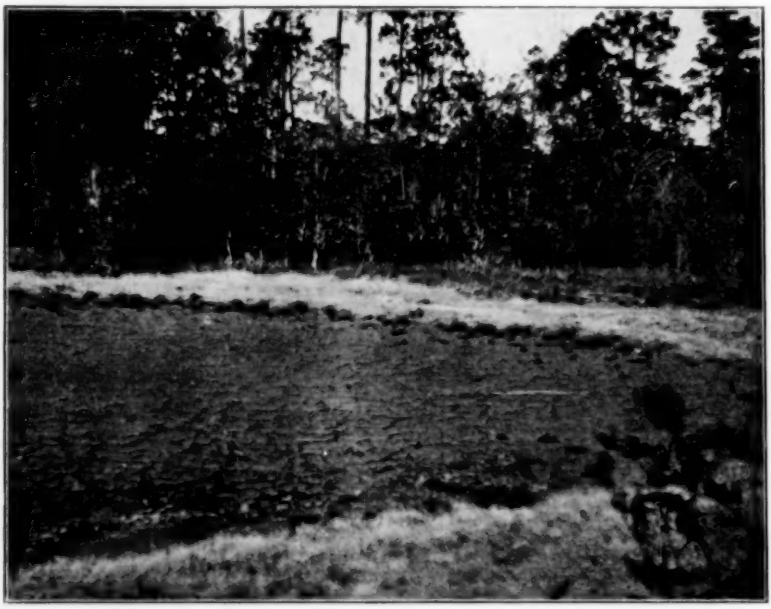

FIG. 4. Type-locality of *Fimbristylis perpusilla*, near Leslie, Sumter County. October 9.

they dry up in summer or fall, but in so doing it changes none of its characters. A depauperate form of *F. Frankii* (also associated with a *Riccia*) has been found by Mr. A. A. Eaton on muddy shores of a pond in Kingston and East Kingston, N. H., but it is quite different from my plant.

By its floral characters *F. perpusilla* seems nearest related to *F. Vahlii*, but in that species (which is not known in Georgia) the culms are densely tufted and erect or nearly so, and the spikelets

are all sessile, while in *F. perpusilla* the culms (8 or 10 to each plant) are prostrate, and of the 3 to 6 spikelets in each umbel some are sessile and some on peduncles 1–4 mm. long. (That part of the original description conflicting with this is erroneous.)

Mr. M. L. Fernald has suggested the resemblance of my plant to *F. dipsacea* (Rottb.) B. & H., an Asiatic species, but this resemblance is probably only accidental. *F. dipsacea* has been treated as the type of a distinct genus (*Echinolytrum* Desv.), on account of some peculiarities of its achenes, which find no parallel in my plant. It should be borne in mind that nearly all the pine-barren plants are endemic species, so that the probability of one of them being identical with an Asiatic species is very small. And there is not the slightest possibility of my plant having been introduced.

RHYNCHOSPORA SOLITARIA Harper, Bull. Torrey Club, **28**: 468. 1901

Collected again at the type-locality in Tifton, September 26 (*no. 1677*); also seen in similar situations in Colquitt County a few days earlier and in Irwin County a few days later. Since seeing this species in the field again I can now indicate its affinities with more certainty. It seems nearest related to *R. ciliaris* (Michx.) Mohr (*R. ciliata* Vahl), from which it differs principally in being more slender and glabrous, with longer erect leaves, narrower spikelets and longer perianth bristles, and in its later flowering period. These two species, together with *R. Baldwinii*, seem to form a small natural group. If my view is correct *R. solitaria* is not a near relative of *R. Tracyi* (which is scarcely a true *Rhynchospora*), which it immediately follows in Dr. Small's Flora.

RHAPIDOPHYLLUM HYSTRIX (Pursh) Wendl. & Drude

This, one of the rarest of our palms, I first found in rich shady woods northwest of Cuthbert, on October 21 (*no. 1769*). Here there were only a few specimens, but a few days later I found it more abundant in similar situations along Samochechobee Creek in Clay County.

This species seems to have been previously known in Georgia only from the type-locality, "near the town of Savannah," but I

am not aware that any botanist now living has seen it in that part of the state.

LACHNOCAULON BEYRICHIANUM Sporleder; Koernicke, Linnaea, **27**: 597. 1854

In rather dry pine-barrens near the eastern edge of Okefinokee Swamp in Charlton County, August 9 (*no. 1491*); also above high-water mark on the sandy shore of Ocean Pond, Lowndes County, September 4 (*no. 1607*). Previously known in Georgia only from the type-locality, "ad ripas paludum prope Ebenezer," where it was discovered by Beyrich about seventy years ago. Dr. Morong, in his remarks on this species,* erroneously places Ebenezer in Middle Georgia. The original Ebenezer, visited by Beyrich, was on the Savannah River in Effingham County, but is now extinct or nearly so. In later years there have been two or three other Ebenezers in Georgia, and it was probably one of these which misled Dr. Morong.

ERIOCAULON TEXENSE Koernicke, Linnaea, **27**: 594. 1854

Collected on July 2 in flat pine-barrens near Huntington, Sumter County, in a place which was quite dry at the time, but becomes a shallow pond in wet weather (*no. 1395*). Previously known only from Texas. (The reference to Florida under this species in Dr. Small's Flora is an error, probably typographical, Georgia having been intended.) This species is about intermediate in appearance between *E. compressum* and *E. decangulare*, and if it has been seen elsewhere in the East it has probably been mistaken for one of these other species.

TRADESCANTIA COMATA Small

In rich woods on Germain's Island in the Savannah River, Columbia County, 15 or 20 miles above the fall-line, June 7 (*no. 1296*). Altitude about 175 feet. Previously reported only from the mountains.

JUNCUS BRACHYCARPUS Engelm.

In river-bottoms near the same island, collected on the same

* Bull. Torrey Club, **18**: 361, 362. D 1891.

day (*no. 1295*). Very few stations for this in the Southeastern States are known, probably no other in Georgia.

MELANTHIUM DISPERSUM Small

Several specimens collected in a sandy bog in the pine-barrens east of Folkston, Charlton County, in full bloom on the morning of August 12 (*no. 1506*). Previously known only from a single imperfect specimen from Walton County, Florida, collected by A. H. Curtiss in 1885. *M. Virginicum*, its nearest relative, flowers a month or two earlier in Georgia.

UVULARIA FLORIDANA Chapm. (*Oakesiella Floridana* Small)

Not rare, in rich damp woods, Dublin, Laurens County, with full-grown fruit in June (*no. 1363*). Seen in October in similar situations near Cuthbert. The fruit, which has not hitherto been described, furnishes additional characters for distinguishing this species from its congeners. The capsule is always acuminate, tapering into a short beak, instead of being obtuse as in the two related species, *U. puberula* and *U. sessilifolia*. The bracted peduncle mentioned by Chapman, but overlooked by Small, seems to be also a perfectly constant character which is not shared by the other species.

CROOMIA PAUCIFLORA (Nutt.) Torr.

Collected in rich shady woods on the bank of the Chattahoochee River in Quitman County, October 16 (*no. 1757*), with flowers and fruit all gone. This is doubtless the only station in Georgia now known for this rare plant. Its resemblance to *Smilax ecirrhata*, which grows with it, is striking.

SALIX FLORIDANA Chapm.

I refer tentatively to this almost unknown species specimens collected in wet woods at the outer (eastern) base of the sand-hills of the Ocmulgee in Pulaski County below Hawkinsville, June 27 (*no. 1381*). My specimens were slender erect trees about ten feet tall and two inches in diameter, with tasteless bark roughish below and smooth above. The twigs were very brittle not only at the bases but throughout. No trace of fruit was found, but my ma-

terial, as far as it goes, seems to be a perfect match for the type-specimen in the Torrey Herbarium, collected by Dr. Chapman in West Florida.

QUERCUS MYRTIFOLIA Willd.

Abundant on the driest sand-hills of the Satilla River in Pierce County near Waycross, where with other shrubby plants (and no herbs or trees) it forms almost impenetrable thickets six to ten feet high and of unknown extent (*no. 1466*). This locality is about 60 miles inland and 100 feet above sea-level. On August 19 I collected the same oak in a thicket of similar aspect, but somewhat different composition, in the interior of Cumberland Island (*no. 1540*). This species strikes me as being much more closely related to *Q. nigra* L. (*Q. aquatica* Walt.) than to *Q. Virginiana*, of which it was long considered a variety.

POLYGONUM ARIFOLIUM L.

In the swamp of the Satilla River in Camden County opposite Woodbine, within the influence of tide, but in fresh water, August 23 (*no. 1563*). My specimens are all sterile. Previous records of the occurrence of this species as far south as the coast of Georgia seem to be lacking. With it I found among other things *Juncus Canadensis* J. Gay, which was also a novelty in these parts.

MAGNOLIA MACROPHYLLA Michx.

This tree is common in rich woods along Samochechobee Creek all the way across Clay County (*no. 1793*), but I have never met with it elsewhere.

SARRACENIA FLAVA × MINOR Harper, Bull. Torrey Club, **30**: 332. Je 1903

Although described from a single specimen, this hybrid seems to be not particularly rare or evanescent. In July, 1902, I found (and photographed) several specimens within a few feet of each other in wet pine-barrens in Douglas, Coffee County (*no. 1437*). Here, as at the type-locality (about sixty miles distant) both parents were growing in the immediate vicinity. The hybrid has shown no tendency to flower yet.

SARRACENIA PURPUREA L.

After looking in vain for this species in Georgia for several years, I found a quantity of it in a sandy bog in Randolph County not far from Coleman (which is several miles outside of the pine-barrens) on October 28 (*no. 1783*). About the same time Mr. Hyde obtained a flowering specimen collected by the late Mrs. Sarah Thompson in Lee County, May 11, 1895.

Dr. Mohr in his "Plant Life of Alabama" says nothing about this species being rare in that state, but it is certainly rare in Georgia, and very few stations for it are known in the other southern states. All of the seven known species of *Sarracenia* have now been found in the coastal plain of Georgia. With the possible exception of Florida, no other state is known to contain them all.

CHRYSOBALANUS OBLONGIFOLIUS Michx.

Specimens collected in Coffee County on July 22 (*no. 1433*) showed a variation apparently hitherto unknown in this species and the genus and family to which it belongs. Many of the flowers had two or three carpels, and several specimens showed both or all three well on the way to maturity. The plants were perfectly normal in other respects, and there is no reason for supposing the extra number of carpels a freak. It is simply a variation which has been overlooked.

CUBELIUM CONCOLOR (Forst.) Raf.

Common on the bank of the Savannah River on Germain's Island, Columbia County (in the metamorphic region), June 7 (*no. 1297*). Also seen among limestone rocks in woods near Grier's Cave, Randolph County, October 23. Not previously reported from Georgia. My specimens differ from those which have been described, in being glabrous throughout, but seem to be otherwise identical.

ERYNGIUM LUDOVICIANUM Morong (*E. integrifolium Ludovicianum* C. & R.)

Observations on this species during the season convince me that it is specifically distinct from *E. integrifolium* Walt. (*E. virga-*

tum Lam.). While the two species are similar in habitat, their ranges are different. Near the southern border of the state, in the counties of Lowndes, Brooks and Thomas, *E. integrifolium* alone occurs, while fifty miles farther north, in the vicinity of Tifton, I have seen only *E. Ludovicianum*. But around Moultrie, an intermediate point, both species occur, often together, without showing any tendency to intergrade.

E. integrifolium has much the wider range, even in Georgia, where it is found in the metamorphic region as well as in the coastal plain. It is represented by *no. 1612*, from Valdosta, September 5, and *E. Ludovicianum* by *no. 1664*, from Colquitt County, September 24.

PANAX QUINQUEFOLIUM L.

In rich shady woods northwest of Cuthbert, Randolph County; also on the high bluff along Samochechobee Creek in Clay County. Rarely found so far south, these localities being below latitude 32°. I have heard several rumors of the occurrence of this much-sought plant elsewhere in the coastal plain, but most of these on being investigated prove to be based on *Tetragonotheca helianthoides* L., a totally dissimilar plant which in some unaccountable way has also received the name of "ginseng," * and moreover is said to possess valuable medicinal properties, being "good for rheumatism."

CHIMAPHILA MACULATA (L.) Pursh

A few specimens seen on September 29 in rich woods near Little River southwest of Tifton, Berrien County. This species does not seem to have been found so far south before.

ANANTHERIX CONNIVENS (Baldw.) Feay; Wood, Class Book, 594. 1861

The authorship of this combination is usually credited to Gray (Proc. Am. Acad. **12**: 66. 1876), but it was published in Wood's Class Book several years earlier. I collected this species in full bloom in wet pine-barrens in Coffee County near Douglas, July 18 (*no. 1426*), and observed it in similiar situations in several other

* This fact was noted by Messrs. Pollard and Maxon in 1900. See Plant World, **3**: 142. S 1900.

Southeast Georgia counties. It seems to be always scarce, rarely more than three or four specimens being visible at once.

DICERANDRA ODORATISSIMA Harper, Bull. Torrey Club, **28**: 479. 1901

Collected on the sand-hills of Little River southwest of Tifton, Berrien County, September 30 (*no. 1695*). At this station, which is probably near the western limit of the species (sand-hills being rare farther west), the plants are much less abundant and vigorous than at the type-locality, forty miles farther east.

GERARDIA GEORGIANA C. L. Boynton, Biltmore Bot. Stud. **1**: 148. 1902

Collected in rather dry pine-barrens around a small pond in Thomas County south of Thomasville on the morning of September 19 (*no. 1637*). Intimately associated with *G. paupercula* (Gray) Britton (*no. 1638*), which it much resembles, though this is not necessarily its nearest relative. Previously known only from the type-locality, near Cordele. One character overlooked by the author is that the corolla of *G. Georgiana* is spotless. I find that the markings of the corollas in *Gerardia*, which can be studied to advantage only in living specimens, often afford valuable diagnostic characters.

GERARDIA FILICAULIS (Benth.) Chapm.

Seen only in rather dry grassy pine-barrens near Tyty, Worth County, on the morning of September 30 (*no. 1698*). Fairly abundant but very inconspicuous. Not previously reported north of Florida.

LOBELIA FLACCIDIFOLIA Small

Collected in the swamp of Cedar Creek near Wrightsville, Johnson County, in flower June 16 (*no. 1341*), also in the swamp of Ochlocknee Creek near Moultrie, Colquitt County, September 25 (*no. 1676*). Flowers earlier than most species of *Lobelia*.

EUPATORIUM INCARNATUM Walt.

Seen only in the rocky woods near Grier's Cave, Randolph County, in flower October 23 (*no. 1771*). Probably not known elsewhere in Georgia. Dr. Mohr reports but one station for it in Alabama.

CHRYSOPSIS PINIFOLIA Ell.

On the fall-line sand-hills near Butler, Taylor County, November 6 (*no. 1802*). The only earlier specimen I have seen was collected by Elliott himself in the same region. This species becomes stoloniferous late in the season, a fact which has not been noted before.

SOLIDAGO AMPLEXICAULIS T. & G. Fl. N. A. **2**: 218. 1842

Not rare in rich shady woods in Randolph County northwest of Cuthbert, in full bloom on October 21 (*no. 1764*). Not previously reported from Georgia. This species was named in a rather unusual way. The authors when describing it assumed it to be the same as *S. amplexicaulis* Martens,* of which they had seen the name but not the description. Soon afterward † they found that Martens' *S. amplexicaulis* was a synonym of *S. Riddellii* Frank. According to the views held at that time, this necessitated no change in the name of Torrey and Gray's plant, but on the principle of "once a synonym always a synonym," it would have to be changed. This is a case which seems to have escaped the attention of the nomenclature reformers.

BALDWINIA ATROPURPUREA Harper, Bull. Torrey Club, **28**: 483. 1901

At the time I described this species I had some doubts as to its validity, but I have none now. In 1902 I collected it near Moultrie on September 20 (*no. 1644*), and in the next two weeks saw it at many other places in the counties of Colquitt, Worth, Berrien, Irwin and Dooly, always in moist slightly sloping pine-barrens. It grows in wetter places than does *B. uniflora* (but the two species are often found near together), and flowers several weeks later. I find also that its involucral bracts are smaller and more numerous than those of its congener. Also that the stems are usually purplish at the base, and commonly produce more branches (and consequently more heads) than in *B. uniflora*. There is not the slightest possibility of confusing the two species, and it is remarkable that *B. atropurpurea* was overlooked so long.

* Bull. Acad. Brux. **8**: 66. 1841.

† Fl. N. A. **2**: 504. 1843.

MARSHALLIA RAMOSA Beadle & Boynton, Biltmore Bot. Stud. 1: 8. *pl. 2.* 1901

In dry pine-barrens and at bases of imperfectly developed sand-hills in Johnson county near Wrightsville. In flower June 16 (*no. 1342*). This seems to be the second collection made of this species. Its corollas are decidedly paler than those of the common species, *M. graminifolia*, being nearly white.

MESADENIA SULCATA (Fernald) Small (*Cacalia sulcata* Fernald)

Collected in wet woods about a mile east of Killen, Clay County, October 29 (*no. 1792*), also seen in similar places in Randolph County south of Cuthbert. The affinity of this species with *Cacalia ovata* Ell. (which may not be the same as *C. ovata* Walt.), to which Mr. Fernald compared it, is rather remote. It is much more closely related to *M. tuberosa* (Nutt.) Britton and *M. Floridana* (Gray) Greene. These three species, *tuberosa*, *sulcata* and *Floridana*, differing from each other principally in range, habitat and shape of leaves, form a small group characterized by grooved or sharply angled stems, plantain-like leaves green on both sides and tapering at the base, and especially by the winged keels of the involucral bracts. This latter character was overlooked by the authors of the two latter species and is very rarely mentioned in descriptions, being inconspicuous in dried specimens. The wings are usually 1–2 mm. broad.

A specimen collected by A. H. Curtiss on "Borders of swamps, Walton County, Florida," in September, probably many years ago (*no. 1560*, distributed as *Cacalia Floridana*), is *Mesadenia sulcata*. In the Biltmore Herbarium there are specimens of it collected at different points in the same county, August 1, 1899, and September 26, 1900.

COLLEGE POINT, N. Y.

The Polyporaceae of North America — VI. The genus Polyporus

William Alphonso Murrill

The genus *Polyporus*, as established by Micheli (Nov. Pl. Gen. 129. *pl. 70–71.* 1729), was such a natural division and so clearly distinguished that it remained intact for over a century. Its nomenclatorial type was *P. leptocephalus* (Jacq.) Fr. and associated with this species were some of the most common and well-known members of the family. Unfortunately, however, Linnaeus retained the name *Boletus* for all pore-bearing fungi, and those mycologists who adopted Micheli's genus failed to establish it according to modern ideas. Adanson, for example, only cited Micheli's figures and listed no properly named species; Haller used only polynomials; and Scopoli in his *Introductio* listed no species at all under *Polyporus*. It was thus left to Paulet (Icon. Champ. *pl. 13.* 1793) to securely establish the genus. Paulet's work, written twenty or more years before its publication, contains descriptions and figures of six species of *Polyporus; P. Ulmi, P. frondosus, P. umbilicatus, P. carbonarius, P. fasciatus* and *P. Tuberaster*, four of which belong to Micheli's genus in the strictest sense. The first species, *P. Ulmi*, is the very common one well known as *P. squamosus* (Huds.) Fr. and must be considered the nomenclatorial type of *Polyporus* according to principles now in vogue. The general use of *Polyporus* instead of *Boletus* is chiefly due to Fries, who, without knowledge of Paulet's work, "restored" the name in 1815 and made it popular in spite of the influence of Linnaeus.

In recent systems of classification the original significance of the term *Polyporus* has been somewhat perverted. Karsten, for example, assigned *Polyporus* to the terrestrial central-stemmed forms and placed the wood-loving species under the new genus *Polyporellus* (Medd. Soc. Faun. et. Fl. Fenn. **5**: 37. 1879). Quélet adopted new names for both of these groups, *Caloporus* for the first and *Leucoporus* for the second, and erected the monotypic genus *Cerioporus* on *Polyporus caudicinus* (Enchiridion Fungorum, 164–167. 1886). Patouillard followed Quélet in the main, but

used *Polyporus* in the Karstenian sense instead of *Caloporus* and proposed the new name *Melanopus* for the group to which Karsten had assigned the name *Polyporellus* (Hymenom. Eur. 137. 1887). One finds, therefore, four modern generic names, *Polyporellus*, *Leucoporus*, *Cerioporus* and *Melanopus*, associated either with the type or with a near ally of the type of the genus *Polyporus* and hence synonymous with it.

The species of this genus are in general very similar in appearance and habit, most of them being small dark-colored plants attached to fallen branches and other decaying wood on or near the ground. One species, however, *P. caudicinus*, is very large and does considerable damage to living trees, especially in Europe where it is abundant. The smallest plant of the genus is *P. Aciculа*, a tropical form only two millimeters in diameter represented by a single specimen in the Kew herbarium. Many other species of this group are based upon very scanty collections, some well preserved, others now in poor condition, and most of them inadequately described. The task of the monographer is, therefore, in this case unusually difficult and his results more or less unsatisfactory.

Synopsis of the North American species

1. Stipe pallid or light brown, centrally attached, not darker than the pileus. 2.
   Stipe wholly or partly black or fuliginous, variously attached, usually darker than the pileus. 17.

2. Margin of pileus not ciliate. 3.
   Margin of pileus ornamented with cilia, which often disappear with age. 12.

3. Pileus beset near the margin with hydnoid processes. 1. *P. hydniceps.*
   Pileus plainly villose, tomentose or scabrous, often becoming glabrous with age. 4.
   Pileus minutely tomentose or glabrous from the first. 8.

4. Pileus scabrous, irregular, umbrinous, margin involute; stipe scabrous, tubes small, 4 to a mm., dissepiments dentate. 2. *P. scabriceps.*
   Pileus villose or tomentose. 5.

5. Pileus becoming virgate from the rupture of the cuticle, tubes 2 to a mm., decurrent, dissepiments dentate. 3. *P. virgatus.*
   Pileus not becoming virgate. 6.

6. Pileus less than 2 cm. in diameter, ochraceous, tubes 2 to a mm., decurrent to the base of the stipe. 4. *P. delicatus.*
   Pileus more than 2 cm. in diameter. 7.

7. Tubes decurrent, very short, entire, pileus dark purple, ornamented here and there with paler radiating lines, surface finely tomentose, becoming glabrous. 5. *P. dibaphus.*

Tubes not decidedly decurrent, denticulate when mature, pileus yellowish to smoky black, villose, at length glabrous, spores oblong, curved, $6 \times 2\ \mu$. 6. *P. Polyporus.*

8. Sporophore goblet-shaped, pileus less than 3 cm. broad, shallowly depressed at the center, stipe long, striate, expanding into the pileus. 7. *P. Tuba.*

Sporophore trumpet-shaped, pileus 5–10 cm. broad, deeply infundibuliform, stipe 3 cm. long, pallid, pulverulent. 8. *P. craterellus.*

Sporophore not as above. 9.

9. Pileus minute, 2 mm. in diameter, umbilicate, margin involute, pores alveolar. 9. *P. Acicula.*

Pileus large, 10 cm. or more in diameter, umbrinous, stipe short, thick, hispid, pores at length sinuous, dissepiments dentate. 10. *P. discoideus.*

Pileus of medium size, 2–5 cm. in diameter. 10.

10. Context whitish or brownish in color, extremely thin. 11.

Context golden-yellow, not extremely thin, tubes remote from the stipe. 11. *P. phaeoxanthus.*

11. Pileus brown, polished, context light brown, tubes decurrent. 12. *P. Columbiensis.*

Pileus white or pallid, more or less translucent, context white, tubes adnate, exceedingly minute, 8 to a mm. 13. *P. obolus.*

12. Tubes alveolar. 13.

Tubes not alveolar. 15.

13. Margin of pileus finely hispid, broadly sterile below, surface ochraceous, radiate-striate, stipe brown, pulverulent. 14. *P. aemulans.*

Margin of pileus strigose, fertile below. 14.

14. Pileus very thin, smooth, pellucid, fragile, stipe thicker below, setulose. 15. *P. arculariellus.*

Pileus not very thin, fuscous-squamulose to glabrous, stipe equal, grooved, squamulose, grayish-fuscous. 16 *P. arcularius.*

15. Tubes fairly regular, stipe slender, not polished, plants rather delicate, cilia variable in form and persistence. 16.

Tubes very irregular, stipe usually thick and polished, pileus tough, umbilicate, yellowish-white with brown marginal band, cilia short, fugacious. 17. *P. variiporus.*

16. Pileus opaque, not translucent, 1–4 cm. in diameter, cilia long, of uncertain duration, plants mostly cespitose. 18. *P. Tricholoma.*

Pileus very thin, more or less translucent, 1–2 cm. in diameter, cilia short, slender fugacious, plants not cespitose. 19. *P. Cowellii.*

17. Pileus squamose, very large, flabelliform, tubes large, alveolar. 20. *P. caudicinus.*

Pileus finely tomentose, drab-colored, with reddish-brown spots, small, circular, tubes rounded, minute. 21. *P. maculosus.*

Pileus glabrous, uniform in color, variable in form, tubes punctiform. 18.

18. Stipe ivory-black below, pileus usually ochraceous, surface scarcely depressed, margin even, not becoming extremely thin. 22. *P. elegans.*
Stipe smoky-black below, pileus usually chestnut-colored, depressed at the center or behind, margin very thin and irregular. 23. *P. fissus.*

1. POLYPORUS HYDNICEPS B. & C. Jour. Linn. Soc. Bot. **10**: 305. 1868

This is one of Wright's plants collected in Cuba. Berkeley's description is characteristically brief, but, fortunately, the type still exists in fairly good condition in the Kew herbarium. It is readily distinguished from all other species in the genus by the short cylindrical or subpyramidal hydnoid processes which it bears on the surface of the pileus near the margin. In shape it is variable and quite irregular, often breaking into fan-shaped lobes as it develops and folding inward or outward at the margin as circumstances determine. The stipe is short, thick, usually blackish and often reticulate. The fruit bodies occur at times in clusters with their stipes closely united at the base. In general appearance this species resembles *Scutiger griseus* and its near allies, but it seems hardly fleshy enough for that group and is moreover so much like species of *Polyporus* in habit that I have retained it in the latter genus as here restricted.

2. POLYPORUS SCABRICEPS B. & C. Jour. Linn. Soc. Bot. **10**: 305. 1868

This species is well named. The type at Kew, collected by Wright in Cuba on decaying wood, is well preserved and still shows the characteristic scabrous covering. Other characters are the dark brown surface, involute margin, decurrent, dentate tubes and short brown stipe. Like most of the Cuban species, it is rare and very imperfectly known as regards distribution and variation.

3. POLYPORUS VIRGATUS B. & C. Jour. Linn. Soc. Bot. **10**: 304. 1868

Six type plants of this species are at Kew, collected in Cuba by Wright. They are of the typical *Polyporus* form and habit with rather delicate, fragile tubes and thin cuticle, which at length ruptures in a way quite characteristic of the species. This plant resembles *P. discoideus*, but is tougher, firmer and somewhat smaller in addition to being virgate.

4. POLYPORUS DELICATUS B. & C. Grevillea, **1**: 37. 1872

Only one small plant of this species is to be found in the Kew herbarium. It was collected in Alabama by Peters, growing on decaying wood. It is uniformly ochraceous in color, tomentose, of soft elastic substance, with a thin undulate revolute margin. The tubes are angular, 2 to a mm., decurrent even to the base and quite collapsed when dry. The stipe is central and radicate, and the buried portion is darker in color than the rest. At first sight, the surface suggests *Polyporus fractipes*, the color being very similar in both, but the central stipe, firmer substance and much larger tubes of *P. delicatus* readily distinguish it from that species.

5. POLYPORUS DIBAPHUS B. & C. Grevillea, **1**: 36. 1872

This plant resembles *P. Polyporus* in many respects, but its pore structure appears to be different. It was collected by Peters in Alabama on trunks of *Ilex*. The type at Kew is the larger share of a single specimen cut in two. A better developed plant might show closer resemblance to *P. Polyporus*. One can never be entirely free from the suspicion that species resting upon a slight material basis and closely resembling species that are common and variable may possibly be only undeveloped or depauperate or abnormal forms of the more abundant species. It seems best, however, in the present instance to consider *P. dibaphus* as distinct until its relationships are more clearly proved.

6. **Polyporus Polyporus** (Retz)

Boletus Polyporus Retz, Vet. Ac. Handl. 253. 1769.

Boletus brumalis Pers. Neues Mag. Bot. **1**: 107. 1794. Batsch, Elench. Fung. *pl. 10, f. 42a.* 1783.

Boletus fasciculatus Schrad. Spic. 154. 1794.

Polyporus brumalis Fr. Obs. Myc. **2**: 255. 1818.

Polyporus luridus B. & C. Grevillea, **1**: 37. 1872.

Polyporellus brumalis Karst. Medd. Soc. Faun. et. Fl. Fenn. **5**: 37. 1879.

Polyporellus Polyporus Murrill, Jour. Myc. **9**: 93. 1903.

There are two forms of this widely distributed plant, both occurring throughout Europe and North America. It was the yel-

low, or vernal, form which Retz described, while Schrader was dealing with the darker autumnal form of the plant. In his synopsis, Persoon separates the two forms as varieties *vernus* and *fasciculatus*. *P. luridus* of Berkeley and Curtis is to be referred to the latter variety.

This species is found on various kinds of decaying wood in forests and groves, usually upon branches lying on the ground. Its persistence far into the winter in the fresh state led Persoon to give it the name by which it is generally known. Among the specimens examined are the following: Tyrol, *Bresadola;* Berlin, *Sydow;* Finland, *Karsten;* Sweden, *Murrill;* Canada, *Dearness*, *Macoun;* Maine, *Ricker;* New Hampshire, *Miss Minns;* Connecticut, *Wright;* New York, *Shear*, *Underwood*, *Overacker;* Delaware, *Commons;* Ohio, *Morgan;* Wisconsin, *Lapham*, *Seymour;* Iowa, *Holway;* Montana, *Anderson*.

7. POLYPORUS TUBA B. & C. Jour. Linn. Soc. Bot. **10**: 305. 1868

This species is founded upon a single collection by Wright in Cuba, the types being at Kew. It is readily recognized by its peculiar goblet-shaped form, resembling a long-stemmed *Peziza* or a young stage of *Cantharellus cibarius*. Its substance is relatively quite thick, the depression at the center being shallow instead of deep as might be expected from its shape. The margin, if not straight, is rolled inward instead of outward, and the stipe is long, slender and undulate.

8. POLYPORUS CRATERELLUS B. & C. Jour. Linn. Soc. Bot. **10**: 305. 1868

The type collection of this species was made by Wright in Cuba. The name is well chosen and refers to a character by which the plant is easily distinguished from its near allies. Plants collected in Louisiana by Langlois are even more deeply infundibuliform than the types and are also somewhat larger. The species occurs on decaying wood and appears usually in small clusters.

9. POLYPORUS ACICULA B. & C. Jour. Linn. Soc. Bot. **10**: 304. 1868

This minute species is represented by a single specimen, two millimeters in diameter, collected on decayed wood in Cuba.

The stipe is long and slender, centrally attached and somewhat hairy at the base. The pileus is umbilicate with involute margin resembling a minute species of *Omphalia* in shape. In general appearance the plant resembles *P. Tricholoma*, but the margin is without cilia and the pores are alveolar.

10. POLYPORUS DISCOIDEUS B. & C. Jour. Linn. Soc. **10**: 303. 1868

This species was collected by Wright in Cuba. It is rather larger than most of the members of the genus, but resembles them closely in habit and structure. Its nearest ally is perhaps *P. virgatus*. Being large, it is rather fleshy, the context becoming soft, corky and elastic when dry. The tubes are rather large, at length sinuose, and become collapsed on drying, indicating a soft condition when fresh.

11. POLYPORUS PHAEOXANTHUS B. & Mont. Sylloge Crypt. 154. 1856

This rare species was collected at Columbus, Ohio, by Sullivant. It grew on fallen oak wood. The type at Paris is in fragments, but these are well preserved. The character by which the species is at once recognized is the deep yellow color of the context. The pileus is convex, reddish-brown, glabrous, scarcely a millimeter thick and about two centimeters broad; the stipe central and concolorous, the tubes minute and remote from the stipe.

12. POLYPORUS COLUMBIENSIS Berk. Lond. Jour. Bot. **1**: 454. 1842

This is one of the thinnest species of the family, resembling a brown cuticle stripped from some fruit having a smooth, waxy, polished coat. It is orbicular in shape with a dark central stipe and small decurrent tubes. The type was sent to Berkeley from the Columbia River region of South Carolina. There is also in the Berkeley herbarium a specimen from Chicalahi, Mexico, bearing the same name, which may be the same species.

13. POLYPORUS OBOLUS Ell. & Macbr. Bull. Iowa Univ. Lab. Nat. Hist. **4**: 68. 1896

A small plant with very thin partially translucent pileus, brown central stipe and exceedingly minute pores. Pileus orbicular,

plane, 1.5–2.5 × 0.03–0.08 cm.; surface minutely tomentose, radiate-rugose, isabelline, fulvous at the center; margin straight or repand, even, glabrous, entirely devoid of teeth or cilia: context 0.2–0.7 mm. thick, tough, white, translucent, especially near the margin; tubes 0.1 mm. long, 8 to a mm., adnate, white, cylindrical, regular, edges thick, entire; spores ovoid, smooth, hyaline, 3.5–4 × 4.5–5 μ: stipe central, tough, elastic, slender, equal, chestnut-colored, glabrous, smooth, much compressed in drying, 2–4 cm long, 1–2 mm. thick.

The above description of this species is made from dried plants now in the herbarium of the New York Botanical Garden, collected by C. L. Smith in Nicaragua.

Type plants kindly furnished me by Macbride agree in all respects with these, being a part of the same collection. The species is nearly related to *P. Tricholoma*, but the pileus is very thin and translucent, the margin entirely glabrous and the pores scarcely one eighth of a millimeter in diameter.

14. POLYPORUS AEMULANS B. & C. Jour. Linn. Soc. Bot. **10**: 304. 1868.

Very little is known of this species beyond the small type collection from Cuba and Berkeley's rather meager description. The types are well preserved, however, and show decided characters. They resemble *P. arcularius* in having alveolar tubes, but these tubes are broad and shallow and disappear near the margin, leaving a sterile marginal band one or two millimeters in diameter. In habit, the species resembles *P. Polyporus*. The whole plant is thin and tough, with brown central stipe.

15. **Polyporus arculariellus** nom. nov.

Favolus Curtisii Berk. Grevillea, **1**: 68. 1872.

One specimen only of this plant seems to have been sent to Kew by Curtis from his North Carolina collections. This is well preserved, however, and shows the very thin pellucid pileus ornamented around the margin with long cilia, the oblong favoloid tubes and the centrally attached tapering stipe that characterize the species. It is a near ally of *Polyporus arcularius*, though smaller and much more delicate, and also closely resembles such ciliated forms as *P. Tricholoma* and its near allies; so that its natural affinities appear to be with *Polyporus* rather than with *Favo-*

lus. It is unfortunate that the existence of a *Polyporus Curtisii* renders it necessary to change the species name in the transfer from one genus to the other.

16. POLYPORUS ARCULARIUS (Batsch) Fr.

Boletus arcularius Batsch, Elench. Fung. 97. 1783. (Mich. *pl. 70. f. 5.* 1729.)

Boletus exasperatus Schrad. Spic. 153. 1794.

Polyporus arcularius Fr. Syst. 1 : 342. 1821.

This species was described by Batsch as follows : " Stipitatus ; stipite subgracili, subclavato ; pileo membranaceo convexo, subulato-fimbriato ; stipiteque concoloribus, spadiceo-rufis ; cellulis latissimis, rhombeis, aequalibus albis." Fries placed it in the genus *Favolus*, which he treated as a subgenus under *Polyporus.* Its tubes are certainly favoloid, but its close relationship to *P. Polyporus* has kept it near this species rather than with species of *Favolus.* Wright's specimen of *P. lentus* from Connecticut seems nothing more than *P. arcularius.* There is at Kew also the remains of a specimen from Ohio, which very probably belonged in the same category.

P. arcularius shows little variation except in size throughout its wide range. It occurs on decaying wood and shows much the same habit as *P. elegans* and *P. Polyporus*, but differs from these species in occurring more abundantly in the south. Specimens have been examined from the following localities : Tyrol, *Bresadola ;* Connecticut, *Earle ;* Pennsylvania, *Everhart ;* New Jersey, *Ellis ;* Georgia, *Ravenel ;* Ohio, *James, Morgan ;* Missouri, *Demetrio ;* Nebraska, *Bates ;* Colorado, *Crandall ;* New Mexico, *Earle ;* Michigan, *Longyear ;* Kansas, *Bartholomew ;* Kentucky, *Price ;* Mississippi, *Ricker ;* Alabama, *Earle, Baker ;* Florida, *Rau, Calkins ;* Mexico, *C. L. Smith.*

17. **Polyporus variiporus** sp. nov.

A small plant resembling *P. Tricholoma*, but firmer and tougher with thicker stipe and more irregular pores. Pileus orbicular, convex to depressed, 1–2.5 × 0.1–0.2 cm., surface glabrous, more or less radiately striate, somewhat concentrically rugose, straw-colored to isabelline, fulvous to chestnut-colored around the margin, which is thin, inflexed, undulate, finely ciliate, the cilia being

fugacious: context 1–1.5 mm. thick, tough, white; tubes 0.5 mm. in length, 2–4 mm. in diameter, very irregular, much elongated radially near the stipe or in marginal folds, not noticeably decurrent, yellowish, polygonal to lamelloid, edges firm, entire, becoming denticulate or fimbriate with age; spores ellipsoid, smooth, hyaline, $4 \times 7\,\mu$: stipe central, hollow, increasing above, lighter than the pileus, subglabrous with a silky luster, 2 cm. long, 2–6 mm. thick, the buried base enlarged, tomentose and frequently black.

This species was collected by Earle on his recent trip to Porto Rico. It grew on sticks buried in sandy soil in woods. The thick stipe and irregular tubes suggest *P. pachypus* of Montagne, but it is evidently not that species. It differs from nearly related ciliated forms in being conspicuously tougher and thicker with tubes that are in one place small, regular and polygonal and in another transformed by confluence into long sinuate furrows resembling the gills of an agaric. This transformation commonly occurs near the stipe or in pockets made by the partial folding of the pileus.

18. POLYPORUS TRICHOLOMA Mont. Ann. Sc. Nat. Bot. II. **8**: 365. 1837. Pl. Cell. Cuba, 249. *pl. 17, f. 1.* 1842

This species was originally well described and figured by Montagne and several specimens of typical plants are still in existence, so that no doubt exists concerning its identity. In addition to this, a large number of fresh specimens have recently been collected in Cuba and Jamaica by Earle and Underwood and some study made of the habits and variations of the species. It is found to grow in abundance throughout the West Indies and Central America, varying but slightly in color, but more in size and surface markings, occurring usually on dead sticks in woods, but sometimes upon logs and even on cocoanut husks. When seen in the fresh state it is commonly pure white and easily mistaken for some small agaric, but often with age and always in drying the color changes to pallid or light yellowish-brown, or even to a pale reddish-brown. The type plants were, of course, dried specimens and happened to be darker than is usual with the species.

Another variation still more marked and the cause of considerable confusion is in the size and persistency of the cilia around

the margin of the pileus. Sometimes they are long and rigid, sometimes short and flexible; they usually disappear at early maturity, but occasionally persist until the plant has passed its prime. It is doubtful if Montagne himself knew of these variations, and it is certain that Berkeley was much confused by them. In dealing with the types of this plant it is best to consider the Cuban specimens only, since plants from elsewhere were later included in the species concept, which are in reality different things. Likewise, in examining Berkeley's specimens of *Polyporus similis*, one must confine himself to the Brazilian plants, since the Cuban ones are only *P. Tricholoma* with the cilia gone. In the same way *P. flexipes*, *P. stipitarius* and a few other species have undoubtedly become confused with *P. Tricholoma* in the minds of not a few mycologists and many collectors.

The following collections are in the herbarium of the New York Botanical Garden: Jamaica, *Earle 502, 592, Underwood 2953*; Cuba, *Underwood and Earle 246, 579, 744, 851*; Mexico, *C. L. Smith;* Nicaragua, *C. L. Smith;* Cozumel Island, *Millspaugh 1556*.

19. **Polyporus Cowellii** sp. nov.

A small light-colored plant resembling an agaric, having a very thin translucent context, minute pores and a slender central stipe. Pileus orbicular, convex to plane, umbilicate, 1–2 × 0.02–0.05 cm.; surface nearly glabrous, minutely concentrically rugose, straw-colored to isabelline, becoming darker and hygrophanous around the margin or in blotches or even over the entire surface, often faintly radiate-striate about the center with delicate white or brown lines; margin very thin, straight or inflexed, somewhat irregular in outline, finely denticulate, the teeth prolonged into short fugacious cilia: context extremely thin, membranous, 0.1–0.2 mm. thick, white or pallid, partially or entirely translucent; tubes 0.2–0.4 mm. long, 3–6 to a mm., larger by confluence, adnate, pallid, polygonal, edges very thin, subentire, becoming fimbriate with age; spores ellipsoid, smooth, hyaline, binucleate, 2.5 × 5 μ: stipe central, solid, very slender, equal, concolorous or slightly darker, pruinose to glabrous, smooth, longitudinally striate, 2–3 cm. long, 0.3–1 mm. thick, soft and milk-white at the center.

This species is described from dried plants collected in the island of St. Kitts by Britton and Cowell during September and

October, 1901. It was found in considerable quantity growing on decaying wood. There is also in the herbarium of the New York Botanical Garden another good collection of this species from Porto Rico made by Mr. and Mrs. A. A. Heller in March, 1899. It also grew on dead wood. This latter collection, however, is not considered typical.

20. POLYPORUS CAUDICINUS (Scop.) Murrill

Boletus caudicinus Scop. Fl. Carn. ed. 2, **2**: 469. 1772.
Boletus Juglandis Schaeff. Fung. **3**: 75. *pl. 101–102.* 1774.
Boletus squamosus Huds. Fl. Angl. 614. 1778.
Polyporus Ulmi Paul. Icon. Champ. *pl. 13.* 1793.
Polyporus squamosus Fr. Syst. **1**: 343. 1821.
Polyporus caudicinus Murrill, Jour. Myc. **9**: 89. 1903.

Exsicc.: France, *Roumeguère 2706, 2707, 3403;* Germany, *Krieger 860, Sydow 212, Magnus, Murrill;* Sweden, *Murrill;* England, *Murrill;* Canada, *Dearness;* Connecticut, *Underwood.*

This species is the largest of the genus and occurs in very conspicuous clusters on the trunks of injured deciduous trees in Europe and America. In London and in some of the cities of Germany I have found it especially abundant on elms, maples, horse chestnuts and other shade trees. It is at present comparatively rare in America and need not here be seriously considered from an economic standpoint for some years to come.

Scopoli's description is not so clear and definite as might be desired, but in the first variety described there can be no question as to the plant he had in mind, for he speaks of it as multiple, lobed, fleshy, large, growing on the trunks of trees, variegated above with darker spots, light-colored beneath, with large polygonal pores. The large pores connect it with the genus *Hexagona*, but its general structure and habit are those of *Polyporus*. Young plants collected in Connecticut, by Underwood, in May, showed very short favoloid tubes with thin toothed dissepiments, a milk-white fleshy-tough context and a scaly pileus differing little in color from that of the mature plant. The odor of the fresh plant is strong and somewhat mealy; the base of the stipe is clothed with short dark-brown or black velvety tomentum. It is quite possible that in this species we have modifications pro-

duced by an abundance of nutritious food such as is not supplied to the common species growing on dead wood. Large size, very rapid growth, ample pores and a somewhat softer context are probably connected with a better food supply and a more vigorous mycelium.

In addition to *Polyporus*, the present species has served as the nomenclatorial type of two recent genera, *i. e.*, *Cerioporus* Quél. (Ench. Fung. 167. 1886) and *Melanopus* Pat. (Hymenom. Eur. 137. 1887).

21. **Polyporus maculosus** sp. nov.

A small tough plant nearly related to *P. fissus*, but minutely tomentose, with rounded nearly glabrous spots of a reddish-brown color. Pileus irregularly orbicular, deeply depressed, 3–3.5 × 0.1–0.2 cm., surface finely and densely tomentose, radiately striate, drab-colored, ornamented with several light-bay or chestnut spots mostly situated about midway between the center and the margin, which is very thin, striate, irregular and somewhat fissured but entirely devoid of teeth or cilia: context 0.5–1.5 mm. thick, tough to corky, pallid; tubes 0.2–0.4 mm. long, 6–7 to a mm., decurrent, pallid or yellowish, subcylindrical, edges entire; spores ovoid, hyaline, smooth, 3 × 4 μ, immature in these specimens: stipe central, solid, woody, tapering upward, chestnut-black at the base with blotches of light-yellow, uneven, subglabrous, 2 cm. long, 2–4 mm. thick.

This plant was collected in Central America by C. L. Smith. The hymenium is not quite mature, but the other characters are well marked. The peculiar reddish spots seem to be caused by the disappearance of the thick tomentum at certain points. The species occurs on wood and has the habit of representative plants of this genus.

22. POLYPORUS ELEGANS (Bull.) Fr.

Boletus elegans Bull. Herb. France, *pl. 46*. 1780.

Boletus nummularius Bull. Herb. France, *pl. 124*. 1782.

Polyporus elegans Fr. Epicr. 440. 1836–1838. Pat. Tab. Fung. 137. 1883–1886.

Abundant throughout Europe and North America on decaying branches and trunks of various trees. Being exceedingly variable in form, it is not strange that in Europe it is confused with its variable near relative, **Polyporus Calceolus** (*Boletus Calceolus*

Bull.) [*Polyporus varius* (Pers.) Fr.], and some European mycologists go so far as to say that *P. elegans* and *P. Calceolus* are the same thing; but field studies in Sweden have convinced me that we have nothing in America to correspond to *B. Calceolus* of Bulliard, whose description and figure of this species may be easily matched with European specimens from either field or laboratory, while even our most closely allied Canadian forms of *P. elegans* fail to connect with the European relative.

The variety first described as *B. nummularius* by Bulliard is quite distinct from the typical form when seen in the herbarium, but when both are picked from the same branch in the woods the differences speedily become of minor importance. In the following partial list of specimens examined, no distinction is made between the two: Tyrol, *Bresadola;* Finland, *Karsten;* Canada, *Macoun, Dearness;* Vermont, *Burt;* Maine, *Ricker, Miss White;* Connecticut, *Earle;* New York, *Underwood, Cooke, Lobenstine;* New Jersey, *Ellis;* Ohio, *Morgan;* West Virginia, *Nuttall;* Michigan, *Ward;* Iowa, *Holway;* Colorado, *Bethel, Crandall;* Washington, *Piper, Parker.*

23. POLYPORUS FISSUS Berk. Lond. Jour. Bot. **6**: 318. 1847
Polyporus trachypus B. & Mont. Syll. Crypt. 154. 1856.

Both of the above names were assigned to plants sent from Ohio. Those sent by Lea were small and undeveloped and one or two were accidentally lobed. The tubes were so small as to be overlooked and he labelled them *Thelephora.* The collection made by Sullivant at Columbus was evidently described by Montagne. The description is accurate and quite complete. The reason why neither of these names has come into common use is due to the fact that our plant was at first miscalled *P. picipes*, a name given by Fries without good reason to plants of *P. calceolus* having particularly black stems. This latter species, so far as we are aware, does not occur in America, but American specimens at Kew are labeled *P. picipes* Fr. In the herbarium of Fries at Upsala there is only one specimen of "*P. picipes*" from North America and that is determined by Ellis. For our common species, then, which has been so generally known as *P. picipes*, we must make use of Berkeley's name.

The plant grows upon dead wood and has the habit of *P. elegans*, but is larger and darker in color. It often persists, however, until bleached nearly white. Exsiccati have been studied from Maine, *Harvey, Miss White;* Connecticut, *Underwood;* Massachusetts, *Seymour;* New York, *Clinton, Overacker;* Pennsylvania, *Everhart;* Vermont, *Farlow;* Kentucky, *Price;* Washington, *Parker;* Michigan, *Wood, Miss Minns.*

SPECIES INQUIRENDAE

Polyporus amygdalinus B. & Rav. Grevillea, **1**: 49. 1872. This species is said to differ from *P. caudicinus* in having smaller tubes, but it is probably only a form of that species in an undeveloped stage. I have not been able to find a type specimen.

Polyporus cyathiformis Lev. Ann. Sci. Nat. Bot. III. **2**: 181. 1844. The type of this species was probably burned with most of Leveillé's types during the occupation of Paris by the Germans. The description corresponds closely with *P. craterellus*, but it is difficult to determine that the two species are identical.

Polyporus pachypus Mont. Pl. Cell. Cuba, 421. 1842. This species is described as caespitose, with thick excentric stipe and membranaceous tubes, which are small and rounded near the margin and large and favoloid near the stipe. No types have been found in foreign herbaria and Montagne himself said in his *Sylloge* that the species needed further investigation.

Polyporus stipitarius B. & C. Jour. Linn. Soc. Bot. **10**: 304. 1868. The original description just cited does not materially assist one in interpreting the type plants in the Berkeley herbarium. Most of these types so closely resemble *P. Tricholoma* that a new description of them seems superfluous; and the one card of specimens which appears to be somewhat different from the rest was listed under *P. Tricholoma* by Berkeley at the time that *P. stipitarius* was described. Judging from the Kew collections, *P. stipitarius* appears to differ from *P. Tricholoma* chiefly in possessing a longer stipe, yet the description calls for a stipe shorter than that of *P. Tricholoma*. New material may possibly throw light on this problem, but I seriously doubt if Berkeley's species can ever be entirely disentangled from the earlier one of Montagne.

Polyporus gracilis Kl. Ann. Nat. Hist. **3**: 384. 1839. This

is a caespitose species with slender pruinose stipe, small pellucid pileus, ciliate margin and very minute polygonal or sinuose tubes. Saccardo considers it the same as *P. flexipes* Fr. and *P. hapalus* Berk., but these two species do not, so far as I know, occur in the West Indies or even in Central America.

Polyporus Humphreyi P. Henn. Hedwigia, **37**: 280. 1898. From the description of this species it appears to resemble *P. Tricholoma*, but has adnate instead of decurrent tubes with whitish fimbriatulate edges. This and the next species are placed here because I have not yet examined the type specimens.

Melanopus marasmioides Pat. Bull. Soc. Myc. France, **18**: 173. 1902. This species is found in Guadeloupe and Martinique and is related to *Favolus melanopus*. It is deeply umbilicate, ochraceous, with translucent denticulate margin, which is sterile below, large shallow radiating tubes and a black central stipe. Undeveloped plants resemble certain species of *Xylaria*. An examination of the plant is necessary to determine whether or not it properly belongs with *Polyporus*.

NEW YORK CITY.

The spines of Fouquieria *

WINIFRED J. ROBINSON

The six species now comprised in the genus *Fouquieria* occupy collectively a region extending from the vicinity of the City of Mexico northward into California, Arizona, New Mexico and Texas. Nearly all of the species find their habitat in arid districts, and the localities from which they have been reported may be comprised within the southern extensions of the Chihuahuan and Sonoran deserts. Among other adaptations, the various species exhibit a capacity for casting off the leaves during seasons of drought, more or less irrespective of the time of the year, while some interesting features of the formation and casting away of the bark have been noticed.

All of the species bear strong spines and seem to be included under the single colloquial name "ocotillo" by the Mexicans, who use the living plants for hedges and sometimes erect barriers by thrusting the ends of heavy branches into the ground in rows. Messrs. Coville and MacDougal report having seen shrubs of *Fouquieria splendens* planted within a few inches of young shade trees in the streets of Alamogordo, New Mexico. The spreading spiny branches were held in a cylindrical clump around the trunk of the tree by means of wire and formed a most effective protection against damage by animals.

During the course of some recent work upon this genus, Mr. G. V. Nash called my attention to the unusual manner in which the spines were formed, which he described as "developed within the petioles of the leaves on the new growth, becoming apparent when these fall." † The general anatomical facts presented seemed of sufficient interest to warrant a detailed examination, and the results of my observations upon *Fouquieria splendens* and *F. Macdougalii*, specimens of which are growing in the conservatories of the New York Botanical Garden, are presented below.

* The results described in the following paper were obtained by the aid of a Research Scholarship in the New York Botanical Garden, in 1903.

† Nash, G. V. A revision of the family *Fouquieriaceae*. Bull. Torrey Club, **30** 449. 1903.

On the lower side of the petiole of the primary leaves, a woody thickening is developed (FIGS. 11 and 12, *w*) which increases in firmness as the leaf matures. This arises from the cortex, which even in the bud is proliferated to form a thickened area on the outer side of the base of each leaf (FIG. 1, *c*). As the leaf emerges from the bud a conical portion of the cortex on the lower side of the petiole begins to lose its parenchymatous character. The cells lengthen, their ends become pointed (FIG. 2, *s*) and their walls thicken; these changes are accompanied by a diminution in their lumina (FIG. 3, *s*). With phloroglucin and hydrochloric acid they take the violet color characteristic of sclerenchymatous cells. The conversion of the parenchyma into sclerenchyma is incomplete in *F. splendens*, and a slender cone shaped mass of thin-walled cells extends about two thirds of the distance from the base toward the tip of the newly formed spine. This is illustrated by the diagrams of longitudinal and transverse sections shown in FIGS. 4, 6 and 7, *p*. About the time when the leaf-blade is cast off, the parenchyma-core disintegrates and a hollow spine remains. In *Fouquieria Macdougalii*, on the other hand, almost the entire mass of the cortex on the outer (lower) side of the petiole is transformed into sclerenchyma, making a solid heavy spine (FIGS. 5 and 8, *s*).

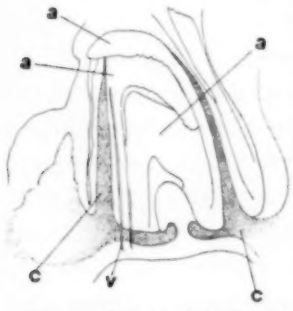

FIG. 1. Section through bud. *a*, young leaf; *c*, cortex, thickened to form spine; *v*, vascular tissue.

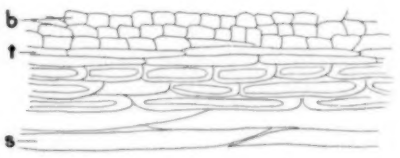

FIG. 2. Portion of longitudinal section through petiole. *b*, cortex; *t*, separating layer; *s*, sclerenchyma.

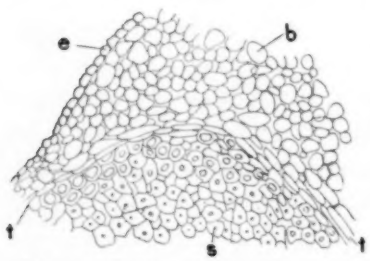

FIG. 3. Portion of transverse section through petiole.

The growth of the leaf and the development of the spine is accompanied by the differentiation of a separatory layer of thin-walled, elongated cells (FIGS. 2 and

3, *t*) in the cortex, between the sclerenchymatous tract and the fibrovascular tissue of the petiole. The sclerenchymatous tissue sustains only mechanical relations to the leaf, and the lamina may be held for extended periods after the completion of the separatory layer. When the vegetative season reaches its end by reason of drought or low temperature, the leaf-blade is cast off; and as its fall occurs simultaneously with its drying out, this desiccation may be taken as the direct cause of the splitting of the separatory layer above mentioned. The separation is identical with that which occurs in the fall of the leaves of many deciduous trees in the autumn in general procedure, but the author is not acquainted with any other instance in which the petiole is cut in a longitudinal plane making necessary a separatory layer two or three centimeters

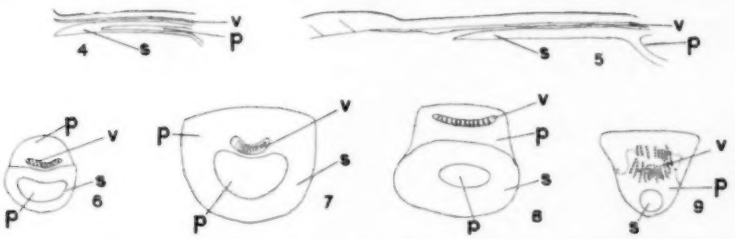

FIG. 4. Diagram of longitudinal section through petiole of *Fouquieria splendens*. *p*, parenchyma; *s*, sclerenchyma; *v*, vascular tissue.

FIG. 5. Diagram of longitudinal section through petiole of *Fouquieria Macdougalii*.

FIG. 6. Diagram of transverse section through petiole of *Fouquieria splendens* near the apex of spine.

FIG. 7. Diagram of transverse section through petiole of *Fouquieria splendens*, near base.

FIG. 8. Diagram of transverse section through petiole of *Fouquieria Macdougalii* near base.

FIG. 9. Diagram of transverse section through petiole of *Fouquieria Macdougalii* near the apex of spine.

in extent (FIG. 13, *d*). Again, this unique method of excision results in leaving an elongated pointed portion of the petiole 3 or 4 cm. in length attached to a mass of thickened epidermis and cork on the stem where it is retained rigidly for an indefinite period. The spine and the contiguous portion of the outer tissues of the stem may easily be pulled from the underlying tissues in *Fouquieria Macdougalii* (FIG. 10, *k*) when they are young, but in *F. splendens* they are less yielding.

In *Idria*, another genus of the same family, a similar spine, originating in the petiole of the leaf, has been described by Poisson (Bull. Mus. Hist. Nat. **1**: 278. 1895) and in some species of the nearly related *Cantua*, of the *Polemoniaceae*, there is a woody ridge at the base of each node. The latter, however, is more like the structure which protects the axillary bud in *Syringa* and *Philadelphus* than the spines of the *Fouquieriaceae*.

The majority of the buds in the axils of the primary leaves do not elongate to form branches, but develop small clusters of spatulate leaves which are almost sessile and do not form spines (FIGS. 11 and 12, *c*).

Engelmann (Bot. Gaz. **8**: 338. 1883) was the first to call attention to this peculiar mode of dehiscence of the leaves of *Fouquieria*. Plank (Garden & Forest, **9**: 73. 1896) says: "The bases of the spines appear to arise in the cellular part, leaving the wood full of holes in their decay," which statement was doubtless made because of the peculiar growth of the cork between the spines and the portions of the outer tissues, which adhere to them, making the spines, with their adhering pieces of bark, dry, papery structures, which still have close enough contact with the adjacent cells to leave a scar when they drop off. Van Tieghem

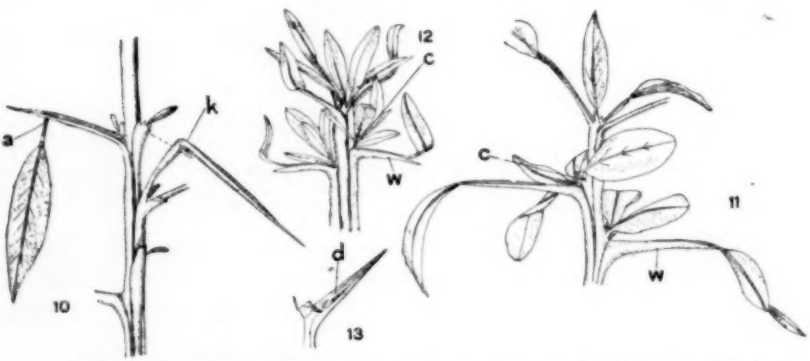

FIG. 10. *Fouquieria Macdougalii*, showing *a*, manner of dehiscence of leaf; *k*, manner in which spine and bark may be peeled from stem.

FIG. 11. Young shoot of *Fouquieria Macdougalii*. *c*, cluster of secondary leaves; *w*, thickening which will form spine.

FIG. 12. Young shoot of *Fouquieria splendens*.

FIG. 13. Spine of *Fouquieria Macdougalii*. *d*, surface from which upper portion of petiole has separated.

(Jour. de Bot. **13**: 295. 1899) has described the leaves of the long branches as having sclerenchymatous cells prolonged from the sclerenchymatous layer beneath the epidermis of the stem, on the under side where the epidermis is in contact with the cortex. He considers this subepidermis as the outer part arising from the division of the cortex into two well-differentiated layers, and criticises Baillon (Hist. Pl. **9**: 242. 1888) for referring to the spines as leaves reduced to a midrib. Such a section as that shown in diagram in FIG. 9, where there are several layers of parenchymatous cells between the sclerenchyma (*s*) and the epidermis, shows that the sclerenchymatous cells arise not from a distinct outer layer of the cortex, but within the cortex. Like the prickles of the blackberry and rose, the spines of *Fouquieria* have no vascular tissue, but unlike them, the sclerenchymatous tissue arises from the cortex, not from the cuticle and the abscission layer is nearly at right angles with the axis of the stem instead of being parallel with it and in the surface of the stem.

Various questions naturally arise in the study of such a structure as the spines of the *Fouquieriaceae*. How did these spines originate? Was the stimulus external or internal which caused the original variation? Is *Fouquieria* a genus that was separated from its parent form at a remote period, so that the intermediate forms between it and the other *Polemoniales* have become extinct, or is it a relatively new genus? Is it a stable form, or do the different plants vary in wide range?

Spinose processes are so characteristic of desert flora that the inference was long ago drawn that there is a close association between their structure and environment. The usual corollaries of spine development, reduction in surface and elaborate adaptations for water-holding, as well as the protective character of the spines themselves in warding off the attacks of animals, are such important factors in the maintenance of a genus in arid regions, that it is easy to reason that they are the outcome of influences in those localities external to the plant.

Kerner, Henslow, and others of the older botanists have been inclined to emphasize the principle that "specific forms, on the whole, fit the places they have to live in," rather than their inherent tendency to variation. No experiments have been performed upon

Fouquieria to test the effect of changed climatic conditions upon it, but it has been observed that in greenhouses the leaves remain attached to the plant a number of months, while in nature they are usually cast off at the end of a few weeks ; and in some years, in the wild state, no leaves are produced. Lothelier's experiments upon the barberry (Rev. Gén. Bot. **2**: 276. 1890) showed that when grown in moist air it loses its spines. Henslow (Jour. Linn. Soc. Bot. **30**: 223. 1895) has made a similar observation for *Ononis spinosa*, one variety of which living upon sandy shores is covered with spines, but becomes less and less spinose in favorable conditions or under cultivation, and he cites the cultivated apple and pear as similar examples. Miss Dale (Ann. Bot. **15**: 59, 497. 1901) has noted that when tubers of *Dioscorea* sent out shoots in light and without moisture, the leaves were scarcely developed at all, and the same thing may now be observed in the Museum of the New York Botanical Garden, where tubers of *Dioscorea* in the exhibition cases have sent out branches, the leaves of which are greatly reduced.

There is a wide gap between *Fouquieria* and *Cantua*, its nearest relative among the *Polemoniales*, which fact together with the small number of species in the genus, its confinement to a limited area, and its stability may be taken to indicate that it is an old form, though there is no geological record so far as is known of any similar spine-bearing form.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1901–1903)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omission their kindness will be appreciated.

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